

Lake Education and Planning Services, LLC  
221B 2nd Street  
Chetek, Wisconsin 54728

# **LITTLE TRADE LAKE, BURNETT COUNTY**

2018-2022 APMP  
WDNR WBIC: 2639300

Prepared by: Dave Blumer, Lake Educator  
November 16, 2017



RTLIA  
Frederic, WI 54837



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# AQUATIC PLANT MANAGEMENT PLAN-LITTLE TRADE LAKE

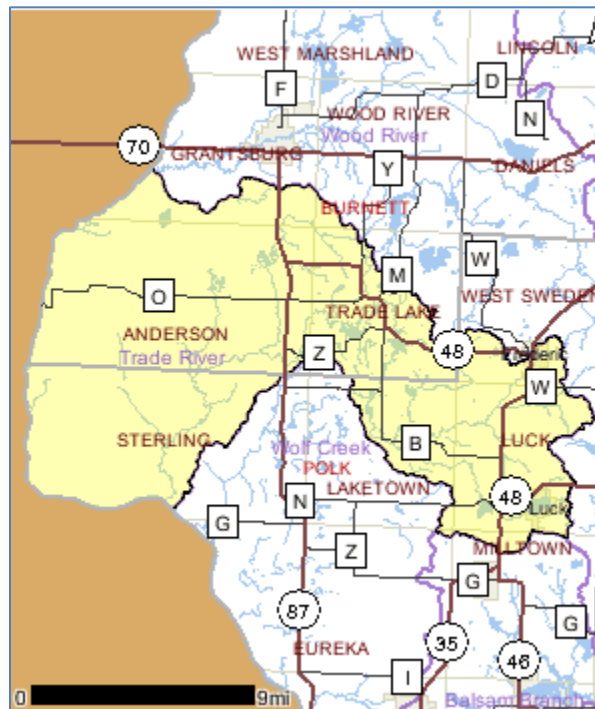
PREPARED FOR THE ROUND-TRADE LAKE IMPROVEMENT ASSOCIATION

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## INTRODUCTION

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Little Trade Lake is a 126 acre lake in Trade Lake Township in Burnett County. Little Trade Lake is located in the Trade River watershed (Figure 1). The Trade River Watershed is approximately 124,754 acres in size and contains 167 miles of streams and rivers, 2,902 acres of lakes and 21,757 acres of wetlands. The watershed is dominated by forest (46%), grassland (19%) and wetlands (17%), and is ranked medium for nonpoint source issues affecting streams.

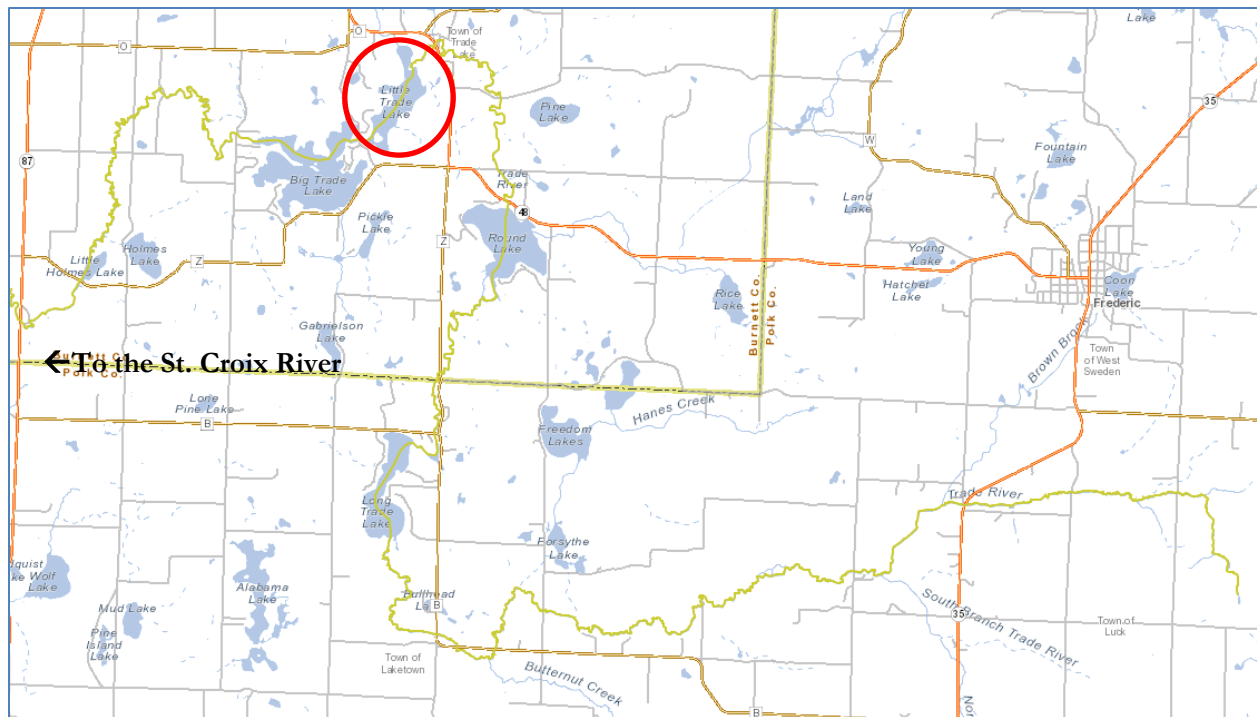


**Figure 1 – Trade River Watershed (SC10)**

Within the watershed, the Trade River begins in Polk County near Luck, WI, flows north in Burnett County and loops back to the south into the northwest of Polk County and then discharges into the St. Croix River (Figure 2). The Trade River flows through a chain of four lakes: Long Trade (Polk County), Round, Little Trade, and Big Trade (Burnett County). Little Trade Lake is the third lake in a chain that the Trade River flows through on its way to the St. Croix River.

These four lakes have been united under a common lake association for many years. The Round - Trade Lake Improvement Association (RTLIA) has been an active and enthusiastic leader in the pioneering efforts at lake management in Wisconsin. The four lakes along the Trade River have exhibited signs of excess fertility for decades. The signs of eutrophication are evident on these waters but a definitive nutrient and hydraulic budget has not been documented. A feasibility study to evaluate the hydraulic and nutrient

loading to the lakes as well as in-lake monitoring to determine recycling and profile characteristics is a high priority for these lakes.



**Figure 2 – Trade River Map – Little Trade Lake (circled in red)**

Little Trade Lake is considered a “Shallow Lowland” lake under the state's Natural Community Determinations. Shallow lowland lakes generally remain mixed throughout the summer season and have water draining from them, and may have water entering them from upstream. Stated lake uses for Little Trade Lake are fishing and swimming, and while it is currently not listed as impaired, it is proposed to be added to the Wisconsin Impaired Waters list in 2018 for Total Phosphorus, Excess Algal Growth, and Eutrophication as in the recent lake assessment it overwhelmingly exceeded acceptable thresholds for these uses. WDNR Watersheds <http://dnr.wi.gov/water/waterDetail.aspx?key=16674>)

Eurasian watermilfoil (EWM) was identified in Little Trade Lake in 2009 and has been managed with the application of herbicides and physical removal each year since except in 2014. Curly-leaf pondweed (CLP), another aquatic invasive species (AIS) has been in the lake for a longer period of time.

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## THE ROUND-TRADE LAKE IMPROVEMENT ASSOCIATION

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The Lake Improvement Association is a non-profit, state incorporated, association comprised of Round Lake, Big and Little Trade Lakes, Long Trade Lake, and Spirit Lake (Spirit Lake is no longer part of the Association). These lakes are located in both Burnett and Polk counties in Wisconsin. The official name is the Round-Trade Lake Improvement Association, Inc., however, it is referred to as the Lake Improvement Association, or more recently the RTLIA. The RTLIA was originally incorporated March 26, 1974, by residents of Round and Trade Lakes with its official offices located in the Township of Trade Lake. The RTLIA is comprised of officers: President, Vice-President, Secretary-Treasurer. Each of the officers is elected through the nomination and vote process of the association's members. There are four board members representing each of the lakes in the association and there is also a lake chairman from each of the four lakes. Regular funding is generated from annual membership dues, with additional funding coming from grants obtained through the state of Wisconsin. Four annual association open meetings are held where members of the association or the public can present ideas or concerns.

The following is a list of actions the RTLIA have implemented over the years. This list should not be considered a complete list, but does reflect the reasons for the efforts made.

- Installed larger culverts on Trade Lake in order to control the lake water levels and reduce flooding of the lakeshore.
- Initiated a plan to control the number of rough fish in Round and Trade Lakes.
- Funded aquatic plant management actions in an effort to control the weed growth for recreational users of the lakes.
- Worked with the DNR to mark hazardous areas with buoys on Trade and Round Lakes.
- Successfully defeated the development of an asphalt plant that was to be located on the Trade River, just north of Round Lake.
- Fought to deter the development of back lot access to Round Lake.
- Introduced weevils into Long Trade Lake in an effort to control the spread of Eurasian watermilfoil.
- Completed Aquatic Plant Management Plans for all four lakes
- Applied for and received State grant funding for planning and control of EWM and CLP
- Completed a study of the water chemistry, macrophytes, and lake sediment of Round Lake.
- Is working to complete a study of the watershed of Long Trade Lake
- Participated in annual state conservation conferences, contributed financially to local causes, and disseminated information to local lakeshore owners on various conservation methods.

Membership in the RTLIA requires payment of dues in the sum of \$30.00 annually. Completed membership forms and investment can be given to any of the officers, board members, lake chairman, or it can be mailed. A current listing of all the officers, board members, and chairman is available by visiting the RTLIA web site at [www.tradelakeassoc.org](http://www.tradelakeassoc.org). Minutes from meetings, additional information about the RTLIA, and many other resources are available on the webpage. The RTLIA is also on Facebook. Some current and future goals for the RTLIA include but are not limited to the following:

- Complete water quality studies of the lakes in the Trade River system
- Develop long-term strategies to maintain and improve the water quality of the lakes in the Trade River system
- Control or reduce the spread of exotic plant species in the lakes and on the surrounding lakeshores.
- Increase active membership in the Lake Improvement Association.

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## **PUBLIC PARTICIPATION AND STAKEHOLDER INPUT**

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## OVERALL MANAGEMENT GOAL

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The overall management goal for Little Trade Lake is to maintain EWM at low levels that do not interfere with lake use. For the purposes of this management plan, that level is less than 1.4 acres as identified annually during a fall EWM bed mapping survey. A secondary goal is to reduce the amount of dense growth CLP in the lake by 50% in five years as measured by spring CLP bed-mapping and to reduce the number of turions in the sediment by 50% after three years of active management.

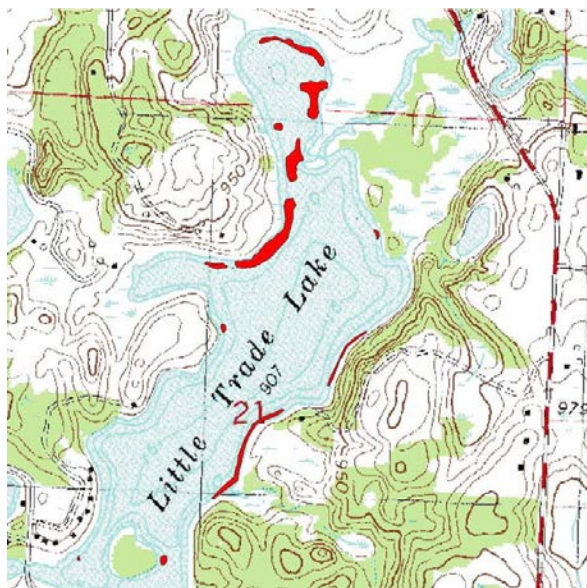
In the previous Trade Lakes Aquatic Plant Management Plan (2011), management objectives for EWM in the entire system included:

1. 75% reduction in dense growth EWM over five years;
2. Preventing EWM from spreading into Big Trade Lake;
3. Preventing EWM from leaving the lake via boat traffic; and
4. Getting property owners to take action to control EWM near their docks and shoreland.

Of these objectives, only the first can be said to have been fully reached. Based on 2016 totals, EWM in all four lakes combined showed an 80% reduction. However, it did spread from Little Trade Lake into Big Trade Lake during this time period. Property owners on Little Trade Lake have not taken an active interest in controlling EWM by their own accord. There is no direct public access on Little Trade Lake however the lake can be accessed by going through Big Trade Lake and under a low bridge into Little Trade Lake. There is no watercraft inspection time recorded on Little Trade Lake, as it does not have its own public access/boat launch.

### EURASIAN WATERMILFOIL (EWM)

Only two whole lake summer surveys of the vegetation in Little Trade Lake have been completed. A summer point-intercept survey was completed in 2009 by Polk County, and a summer point-intercept survey was completed again in 2016 by Endangered Resource Sciences (ERS). During the 2009 survey, about 5.25 acres of EWM was identified (Figure 3), and in 2016 no EWM was identified during the summer survey.



**Figure 3 – 2009 (Polk County) Summer EWM; there was no EWM identified at any point in the 2016 Summer PI Survey**

## CURLY-LEAF PONDWEED (CLP)

One of the goals in the 2011 Trade Lakes APM Plan was to document the extent of CLP in each of the four lakes, and then to create an addendum to the existing plan focused on control of CLP. This goal was met, with a CLP management plan for all four lakes being completed in 2012. At the time of the CLP bed-mapping survey on Little Trade Lake, most of the lake's littoral zone was dominated by nearly monotypic canopied beds of CLP covering nearly 50 acres of the lake (Figure 4). Point-intercept survey work done in 2012 identified 139 of 336 survey points with CLP - 108 of those points had a rake fullness rating of 2 or 3 on a 1-3 scale (Figure 5). The overall density rating for CLP in 2012 was 2.43 (Table 1).

Once the extent of CLP in Little Trade Lake was known, several scenarios for management were proposed. The excepted scenario, which was first implemented in 2013, targeted a partial lake restoration through limited CLP management along with a goal of managing all EWM that was in the lake. Application of herbicides targeted all areas of EWM, and treated CLP in the same areas that EWM was managed. Once CLP management began, it was planned to be continued for a minimum of three years.

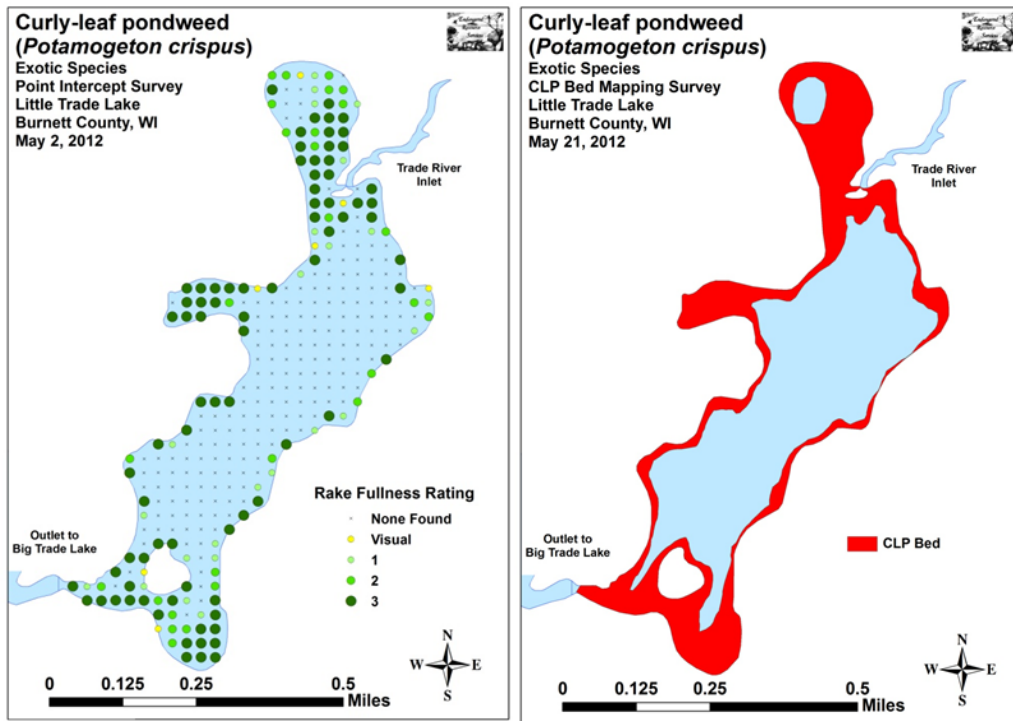
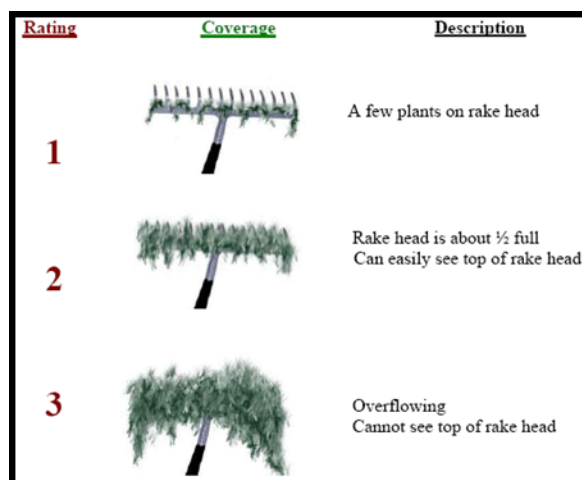


Figure 4 – 2012 CLP Point-intercept Survey and Bed-mapping

Table 1 – 2012/2016 CLP Comparisons

Little Trade Lake 2012/16 Comparison				
Year	Total Acres	Pts w/CLP	Mod/Dense	AveRakeDens
2012	52	139/336	108	2.43
2016	41	120/336	86	2.18





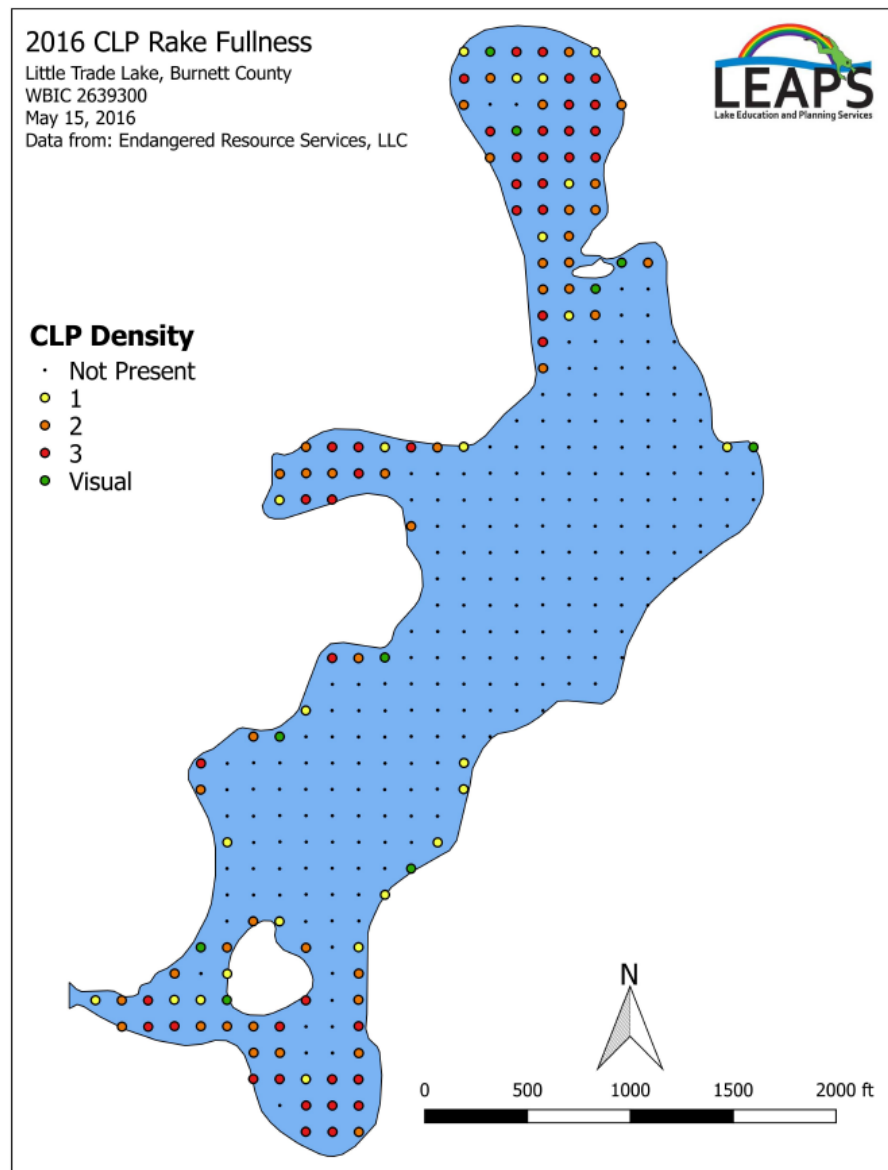
**Figure 5 – Rake Fullness Ratings**

In 2013, 5.14 acres of EWM and CLP were treated using a combined treatment of endothall and 2,4-D. Additional acreage was proposed for treatment in 2014, however high water conditions made it impossible for the herbicide applicator to access Little Trade Lake under the bridge until well into June, at which point it was considered too late to complete a treatment. Management of EWM and CLP resumed in 2015 with endothall only, and in 2016 again with endothall and 2,4-D together yielding outstanding results. With very limited EWM in the fall of 2016, and a shortage of treatment funds in 2017, no EWM or CLP was treated in Little Trade Lake in 2017 (Table 2).

**Table 2 – 2013-2017 CLP/EWM Management on Little Trade Lake**

AIS Management on Little Trade Lake, 2013-2017					
Task	2013	2014	2015	2016	2017
APM Plan				X	X
AIS Control Grant				X	X
AIS Rapid Response Grant					
Spring EWM Treatment (acres)	5.14	P	6.52	10.05	none
Fall EWM Bed Mapping	X	X	X	X	P
EWM Physical Removal	X	X	X	X	
CLP Bed Mapping	X	X	X	X	
Spring CLP Treatment (acres)	5.14	P	6.52	10.05	none
Pre-treatment Plant Survey	X	X	X		
Post Treatment Plant Survey	X		X		
Whole-lake PI Survey				X	
X= Completed, P=Proposed					

Point intercept survey work in 2016 identified 120 of 336 points with CLP, with 86 of those points having a rake fullness rating of 2 or 3. The overall density rating for CLP was 2.18. CLP bed-mapping in 2016 identified approximately 41.25 acres of CLP left in the lake after treatment. Of that acreage, 32.25 acres were considered moderate or dense with a rake fullness rating of 2 or 3 on a 1-3 scale (Table 1, Figures 5&6). CLP management in 2018 and beyond will target both the CLP located in the same areas as proposed EWM treatments, and additional acreage along developed shores with the intent of reducing the total presence of CLP (actual plant acreage and turions) to 50% or less of 2016 levels within five years. A continued goal would be to reduce the total presence of CLP by at least another 50% within ten years. Turion reductions would be based off of 2018 survey numbers.



**Figure 6 – 2016 CLP Point-intercept Survey and Bed-mapping**

#### **ADDITIONAL MANAGEMENT GOALS FROM THE 2011 APM PLAN**

Additional management recommendations made in the 2011 APM Plan included preventing the spread and introduction of other aquatic invasive species; preserving, protecting, and enhancing the lake's native aquatic plant community; and minimizing runoff of pollutants, nutrients, and sediment from the Trade River Watershed. In an effort to reach these goals and meet the objectives stated for them, the RTLIA continued participation in a purple loosestrife biological control program by raising beetles; sponsored several AIS educational events; participated in AIS monitoring; and encouraged property owners to leave native aquatic plants in place along their shorelines. Developing a nutrient budget and watershed management plan was also included as a management objective, however the process to begin doing this has only been started since 2016, and then only for Long Trade Lake at the top of the Trade River system that includes Long Trade, Round, Little Trade, and Big Trade Lakes.

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## WISCONSIN'S AQUATIC PLANT MANAGEMENT STRATEGY

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The waters of Wisconsin belong to all people. Their management becomes a balancing act between the rights and demands of the public and those who own property on the water's edge. This legal tradition called the Public Trust Doctrine dates back hundreds of years in North America and thousands of years in Europe. Its basic philosophy with respect to the ownership of waters was adopted by the American colonies. The US Supreme Court has found that the people of each state hold the right to all their navigable waters for their common use, such as fishing, hunting, boating and the enjoyment of natural scenic beauty.

The Public Trust Doctrine is the driving force behind all management in Wisconsin lakes. Protecting and maintaining that resource for all of Wisconsin's people are at the top of the list in determining what is done and where. In addition to the Public Trust Doctrine, two other forces have converged that reflect Wisconsin's changing attitudes toward aquatic plants. One is a growing realization of the importance of a strong, diverse community of aquatic plants in a healthy lake ecosystem. The other is a growing concern over the spread of AIS, such as EWM. These two forces have been behind more recent changes in Wisconsin's aquatic plant management laws and the evolution of stronger support for the control of invasive plants.

To some, these two issues may seem in opposition, but on closer examination they actually strengthen the case for developing an APMPs as part of a total lake management picture. Planning is a lot of work, but a sound plan can have long-term benefits for a lake and the community living on and using the lake.

The impacts of humans on Wisconsin's waters over the past five decades have caused public resource professionals in Wisconsin to evolve a certain philosophy toward aquatic plant management. This philosophy stems from the recognition that aquatic plants have value in the ecosystem, as well as from the awareness that, sometimes, excessive growth of aquatic plants can lessen our recreational opportunities and our aesthetic enjoyment of lakes. In balancing these, sometimes competing objectives, the Public Trust Doctrine requires that the State's public resource professionals be responsible for the management of fish and wildlife resources and their sustainable use to benefit all Wisconsin citizens. Aquatic plants are recognized as a natural resource to protect, manage, and use wisely.

Aquatic plant protection begins with human beings. We need to work to maintain good water quality and healthy native aquatic plant communities. The first step is to limit the amount of nutrients and sediment that enter the lake. There are other important ways to safeguard a lake's native aquatic plant community. They may include developing motor boat ordinances that prevent the destruction of native plant beds and reduce shoreline erosion and sediment disturbance caused by boat wakes, limiting aquatic plant removal activities, designating certain plant beds as critical habitat sites and preventing the spread of non-native, invasive plants, such as EWM.

If plant management is needed, it is usually in lakes that humans have significantly altered. If we discover how to live on lakes in harmony with natural environments and how to use aquatic plant management techniques that blend with natural processes rather than resist them, the forecast for healthy lake ecosystems looks bright. To assure no harm is done to the lake ecology, it is important that plant management is undertaken as part of a long range and holistic plan.

In many cases, the development of long-term, integrated aquatic plant management strategies to identify important plant communities and manage nuisance aquatic plants in lakes, ponds or rivers is required by the State of Wisconsin. To promote the long-term sustainability of our lakes, the State of Wisconsin endorses the development of APMPs and supports that work through various grant programs.

There are many techniques for the management of aquatic plants in Wisconsin. Often management may mean protecting desirable aquatic plants by selectively hand pulling the undesirable ones. Sometimes more

intensive management may be needed such as using harvesting equipment, herbicides or biological control agents. These methods require permits and extensive planning. Often using an Integrated Pest Management (IPM) strategy that incorporates multiple management actions/alternatives works the best.

While limited management on individual properties is generally permitted, it is widely accepted that a lake will be much better off if plants are considered on a whole lake scale. This is routinely accomplished by lake organizations or units of government charged with the stewardship of individual lakes.

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## LAKE INVENTORY

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In order to make recommendations for aquatic plant and lake management, basic information about the water body of concern is necessary. A basic understanding of physical characteristics including size and depth, critical habitat, water quality, water level, fisheries and wildlife, wetlands and soils is needed to make appropriate recommendations for improvement.

### PHYSICAL CHARACTERISTICS

Little Trade Lake is the third in a series of four lakes located on the Trade River located about 6 miles west of Frederic, Wisconsin. Little Trade Lake is occasionally thought to be a part of Big Trade Lake, just west of Little Trade Lake, but for planning purposes these are two separate lakes with unique issues that will require some different management strategies. According to the Wisconsin Department of Natural Resources (WDNR), Little Trade Lake has a surface area of 126 acres with a maximum depth of 19-ft and a mean depth of 15-ft. Physical characteristics of the lake, derived from GIS and other sources are provided in Figure 7 and Table 3.

Only 4% of the Little Trade Lake watershed is covered by open water, and only 7% of that open water is found in Little Trade Lake. Land cover around the lake has an incredible impact on the lake which is why it is considered in this plan. The Little Trade Lake watershed is covered primarily by forest land (41%) and land used for agriculture such as row crops and pasture (39%). The rest of the Little Trade Lake watershed is covered with development such as towns and residential areas (7%), wetlands (6%), and undisturbed grassland and scrub brush.

Land cover and land use management practices have a strong influence on water quality. Increases in impervious surfaces, such as roads, rooftops and compacted soils, associated with residential and agricultural land uses can reduce or prevent the infiltration of runoff. This can lead to an increase in the amount of rainfall runoff that flows directly into Little Trade Lake and its tributary streams. The removal of riparian, i.e., near shore, vegetation causes an increase in the amount of nutrient-rich soil particles transported directly to the lake during rain events.

Little Trade Lake has no public boat launching site of its own, but is connected to Big Trade Lake via a channel that passes under a low bridge. Big Trade Lake has two public access sites, one on the east side of the lake and one near the outlet on the west side of the lake. Under periods of low or normal water level, most boats and pontoons can pass under the bridge. However under high water periods in the spring and after large rain events, only small watercraft can pass under the bridge.

The low bridge between Big and Little Trade lakes complicates management actions, as it is nearly impossible to get harvesting equipment into Little Trade Lake in the usual manner, and if high water occurs during the proposed AIS chemical treatment period, even access by the herbicide applicator is limited. Furthermore, high water conditions mean a lot of water moving through the entire lake with a very short residence time. Under this scenario, application of herbicides is not desirable.

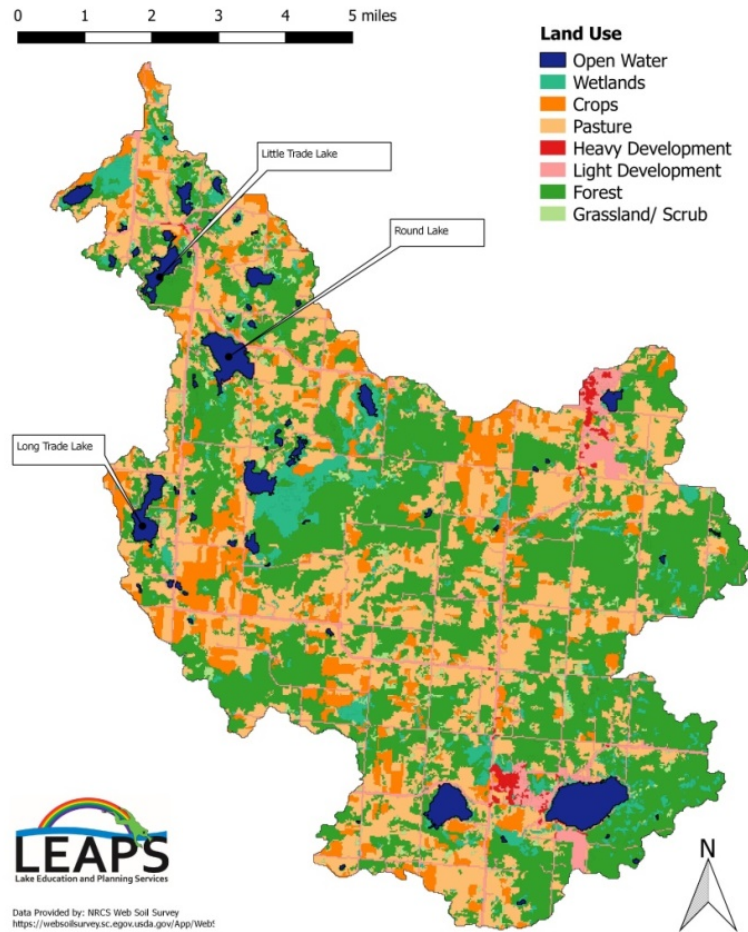


Figure 7: Location and Watershed Land Use for Little Trade Lake, Burnett County (LEAPS, 2017)

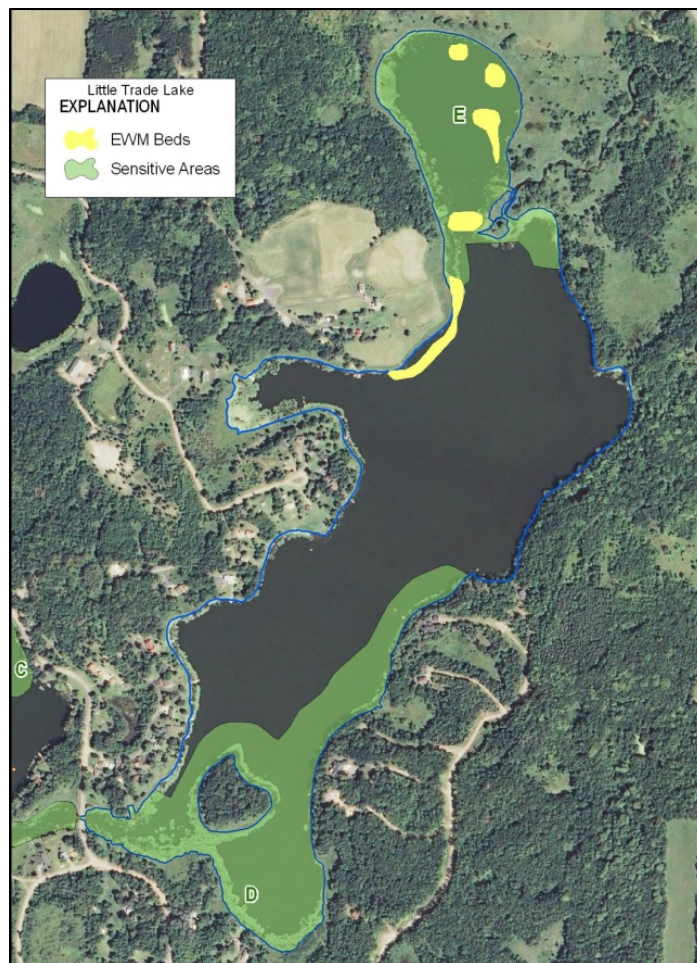
Table 3: Physical Characteristics of Little Trade Lake in Burnett County

Lake Characteristics	
Lake Area (acres)	108
Watershed Area (acres)	40,248
Maximum Depth (feet)	19
Mean Depth (feet)	15
Miles of Shoreline	4.5
Lake Type	Drainage

Watershed Characteristics	
Open Water	1,548
Wetlands	2,492
Agriculture	15,549
Development	3,029
Forest	16,427
Grassland/ Scrub	1,203

## CRITICAL HABITAT

Every body of water has areas of aquatic vegetation that offers critical or unique fish and wildlife habitat. Such areas can be identified by the WDNR and identified as Sensitive Areas per Ch. NR 107. Figure 8 shows the sensitive areas identified by the WDNR (2000) in Little Trade Lake. Aquatic habitat areas provide the basic needs (e.g. habitat, food, nesting areas) for waterfowl, fish, and wildlife. Disturbance to these areas during mechanical harvesting should be avoided or minimized and chemical treatment is generally not allowed. Areas of rock and cobble substrate with little or no fine sediment are considered high quality walleye spawning habitat. No dredging, structures, or deposits should occur in these sensitive areas. Further details for each sensitive area can be found in the Big and Little Trade Lakes Sensitive Area Survey Report and Management Guidelines (WDNRa, 2000) (Appendix A).



**Figure 8: Sensitive Areas and EWM beds in Little Trade Lake**

## WATER QUALITY

One of the most commonly used metrics of water quality is the trophic state of a lake. The trophic state is defined as the total load of biomass in a waterbody at any given time (Carlson & Simpson, 1996). To determine the trophic state of any given lake, the Trophic State Index (TSI) is generally used. This index uses the three main variables of Secchi depth, total phosphorus, and chlorophyll concentration. TSI values are technically limitless, but when applied, they almost always fall between 0 and 100. To make sense of these values, they are broken into different trophic states. The four main trophic states are oligotrophic,



mesotrophic, eutrophic, and hypereutrophic (Figure 9). Oligotrophic lakes are usually very clear, clean lakes with low nutrient levels. Mesotrophic lakes are moderately clear with some nutrients and more plants present within the system. Eutrophic lakes have excess nutrients that support a great deal of algae growth, and may have a large aquatic plant community. Hypereutrophic lakes are very green with dense algae and limited plant growth. Little Trade Lake is considered to be a eutrophic lake.

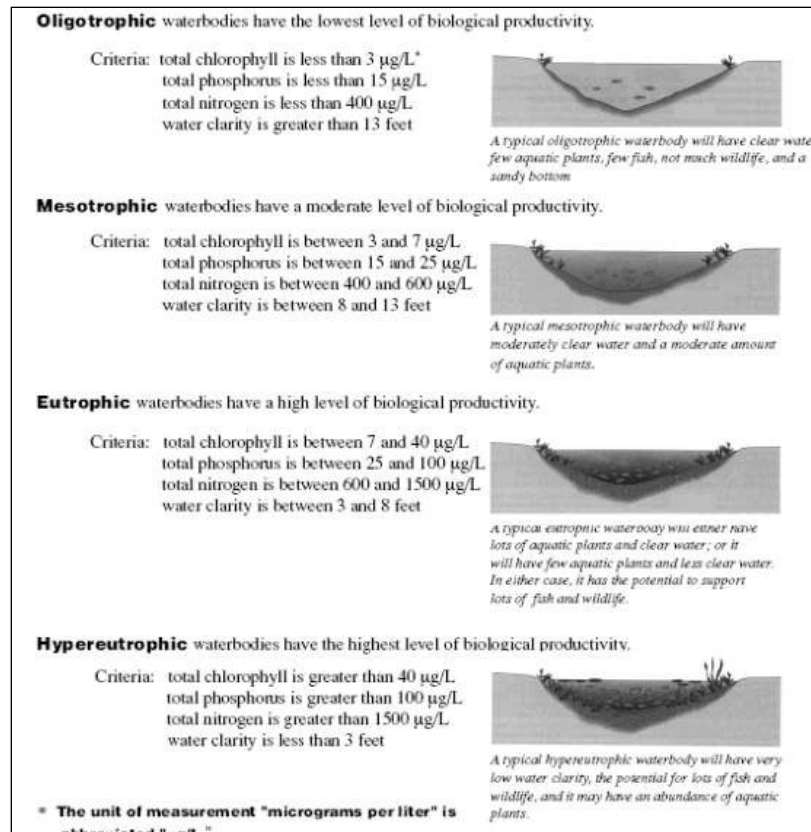


Figure 9 – Trophic status in lakes

Up until recently, Little Trade Lake has been considered to be in good condition from a water quality standpoint. However, it is proposed to be added to the Wisconsin Impaired Waters list in 2018 by the WDNR for Total Phosphorus, Excess Algal Growth, and Eutrophication as in the recent lake assessment it overwhelmingly exceeded acceptable thresholds for fishing and swimming. This means that Little Trade Lake is now thought to be impaired, and it is not meeting its desired uses.

Water quality data was collected by Citizen Lake Monitoring Network (CLMN) volunteers from 2000 to 2003 and more recently, starting again in 2014. While there is a good sized gap between data collection, the data that was collected was done fairly consistently throughout the entire season (June through August). All data collected has been gathered from the Deep Hole site in the north central portion of Little Trade Lake (Figure 10). Total phosphorus data has been collected regularly since 2014. The three years of data that are currently available (2014 to 2016) show a fairly regular pattern. Average yearly TSI to total phosphorus is 61.4. The available data falls fairly close to this number suggesting little change in this value with time. This TSI value suggests that Little Trade Lake is eutrophic from a total phosphorus standpoint.

Average summer Trophic State Index (TSI<sub>CHL</sub>) values for chlorophyll data are limited to the same time frame as the total phosphorus data (2014-2016), but this too was collected on a regular basis. The average yearly chlorophyll TSI was 62.6 which suggest that Little Trade Lake is eutrophic from a chlorophyll standpoint as well.



Secchi depth data also suggests that Little Trade Lake is eutrophic from a water clarity perspective. Secchi data was collected regularly from 2000 to 2003 and again from 2014 to 2016. The average TSI value for Secchi depth was 57 which is eutrophic bordering on mesotrophic.

The last APMP to be completed in 2011 used the Secchi data to determine that Little Trade Lake was eutrophic at that time. Additional data collected since then confirms this.

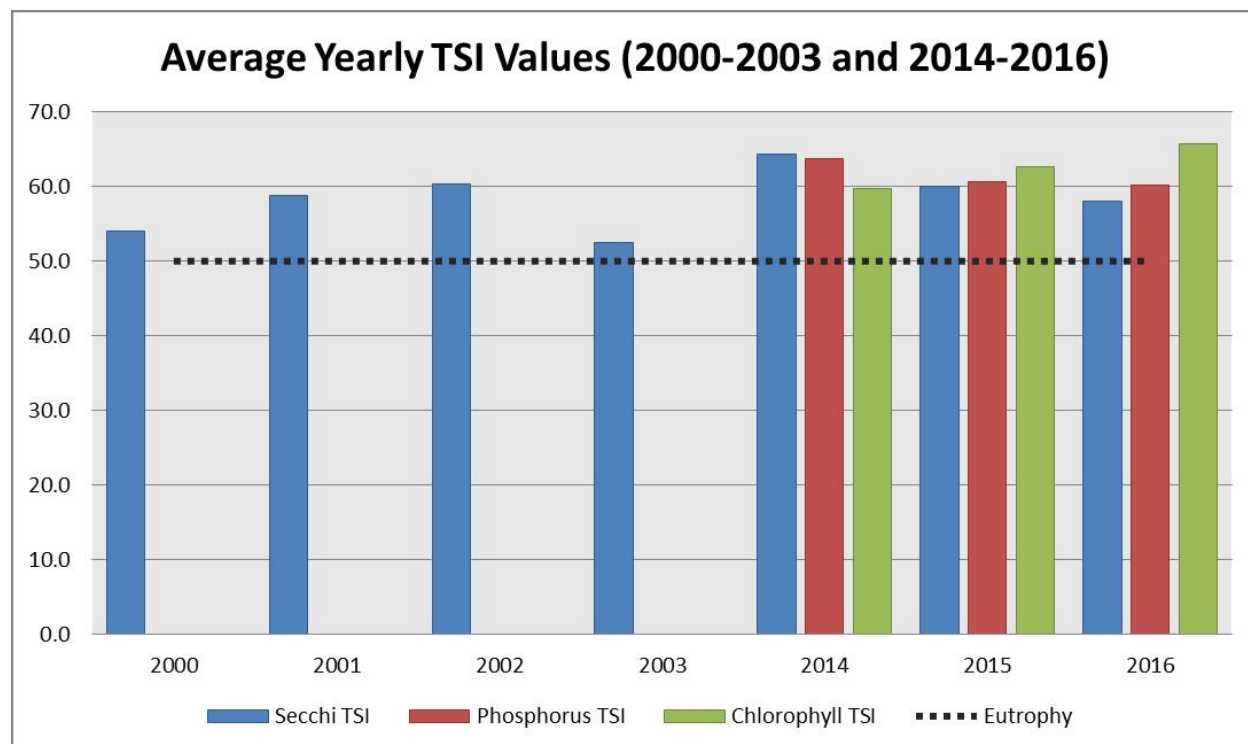


Figure 10: Yearly TSI Values for Secchi depth, Total Phosphorus, and Chlorophyll-a

## FISHERIES AND WILDLIFE

There is no record of any official stocking on Little Trade Lake, but it is likely that some of the fish stocked on Big Trade Lake make their way into Little Trade Lake through the channel that connects these lakes. Big Trade Lake has been stocked with large fingerling musky regularly since 1991. Big Trade Lake was also stocked with one million walleye fry in 1991, but has not been restocked with walleye since then (WDNRc, 2016).

Overall fisheries data is sparse for Little Trade Lake however inferences can be made about the fish populations in Little Trade Lake with the use of fisheries data from Big Trade Lake. The most recent survey of Big Trade Lake was conducted in 2008<sup>1</sup>. The Big Trade Lake survey showed a very large population of bluegill and largemouth bass while the walleye population was almost nonexistent. The musky population was also noticeably small with only 11 fish being found in 2008 despite 217 large fingerlings being stocked into Big Trade Lake that same year.

Currently there are no known non-native, invasive animal species that have established populations in Little Trade Lake. Both Chinese mystery snails and rusty crayfish have been found along the Trade River which runs through Little Trade Lake, but these animals have not been observed within the lake.

The Natural Heritage Inventory (NHI) database contains recent and historic observations of rare species and plant communities. Each species has a state status including Special Concern (SC), Threatened (THR) or Endangered (END). There is one plant (Brittle Prickly-pear [THR]) and one reptile species (Blanding's turtle [SC]) that are found within the same township and range as Long Trade Lake (T36N, R18W).

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<sup>1</sup> All 2013 survey data was provided by Craig Roberts, WDNR fisheries biologist for Burnett County via email correspondence on January 4th, 2017.

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## ATTRIBUTES TO HELP MAINTAIN A HEALTHY LAKE AND WATERSHED

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### WETLANDS

A wetland is an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions. Wetlands have many functions which benefit the ecosystem surrounding Little Trade Lake. Wetlands with a higher floral diversity of native species support a greater variety of native plants and are more likely to support regionally scarce plants and plant communities. Wetlands provide fish and wildlife habitat for feeding, breeding, resting, nesting, escape cover, travel corridors, spawning grounds, and nurseries for mammals and waterfowl.

Wetlands also provide flood protection within the landscape. Due to the dense vegetation and location within the landscape, wetlands are important for retaining stormwater from rain and melting snow moving towards surface waters and retaining floodwater from rising streams. This flood protection minimizes impacts to downstream areas. Wetlands provide water quality protection because wetland plants and soils have the capacity to store and filter pollutants ranging from pesticides to animal wastes.

Because they act as buffers between land and water, wetlands also provide shoreline protection for Little Trade Lake. They protect against erosion by absorbing the force of waves and currents and by anchoring sediments. This shoreline protection is important in waterways where boat traffic, water current, and wave action cause substantial damage to the shore. Wetlands also provide groundwater recharge and discharge by allowing the surface water to move into and out of the groundwater system. The filtering capacity of wetland plants and substrates help protect groundwater quality. Wetlands can also stabilize and maintain stream flows, especially during dry months. Aesthetics, recreation, education and science are also all services wetlands provide. Wetlands contain a unique combination of terrestrial and aquatic life and physical and chemical processes.

There are not very many wetlands along the shorelines of Little Trade Lake; however one area along the northern shore of the lake surrounds the Trade River inlet to Little Trade Lake. There are several other wetland complexes along the river between Round and Little Trade Lakes (Figure 11). These wetland areas are likely helping to filter nutrient rich water from Round Lake before it enters Little Trade Lake.

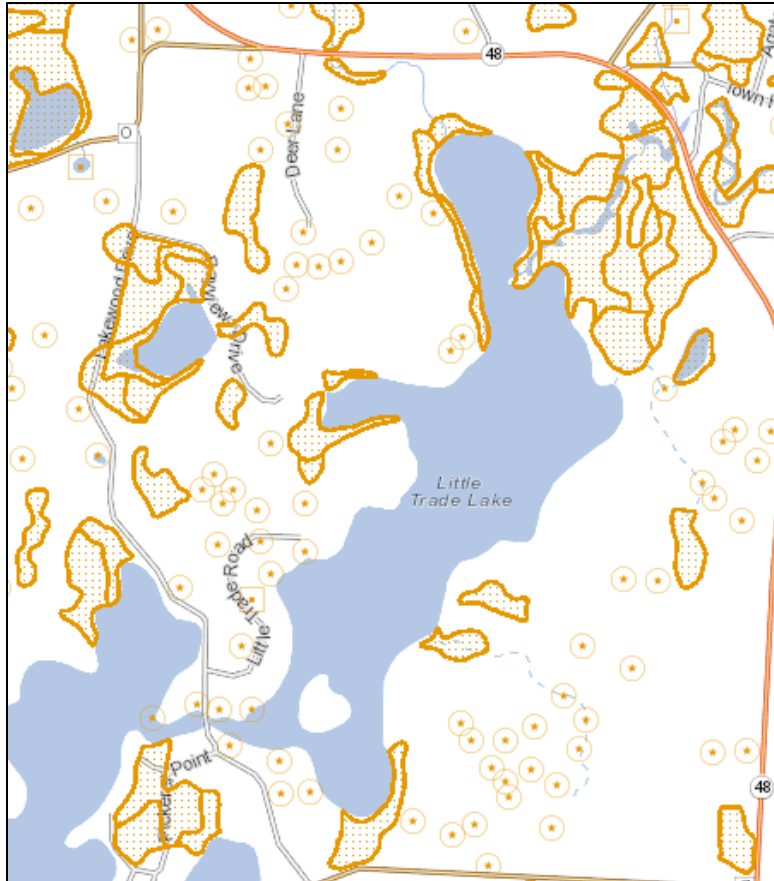
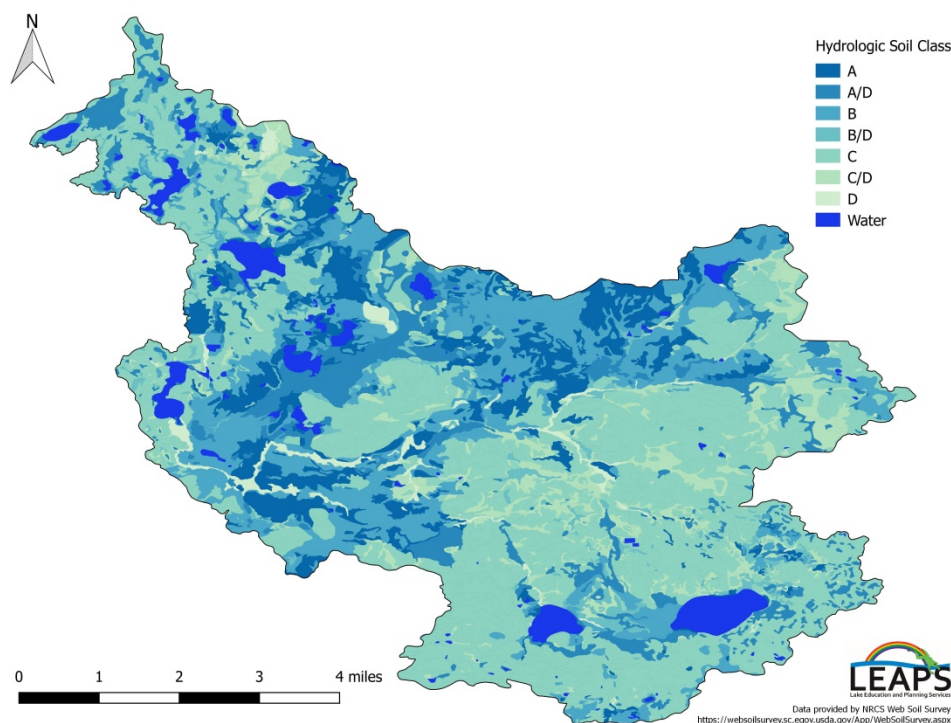


Figure 11: Little Trade Lake Wetlands (Wisc. Wetlands Inventory January 4<sup>th</sup>, 2017)

## SOILS

Soils are classified into four main hydrologic soil groups (A, B, C, and D) to indicate their potential for producing runoff. Group A soils have a high infiltration rate which makes the potential amount of runoff very low. These soils are, generally very sandy and allow water to pass through unimpeded. Conversely, group D soils have a very low infiltration rate making their runoff potential fairly high. Group D soils are generally very dense with high amounts of organic material. This causes water to move slowly through group D soils often resulting in standing water on flat surfaces and flowing water over sloped surfaces. Group D soils are usually contained to wetland areas.

There are also three sub groups (A/D, B/D, and C/D) these indicated the infiltration rate of the soils with respect to the water table. If the water table is high and blocking infiltration, these soils are considered to have a high runoff potential and placed into group D, but when the water table is lower, these soils are similar to the first grouping. About 52% of the soils within the Little Trade Lake watershed fall into groups C or C/D (NRCSa, 2016) (Figure 12). These soils are very good for agriculture, but they also have a fairly high runoff potential. If managed appropriately, the runoff can be minimized in these areas.



**Figure 12: Hydrologic Soil Group Classification in the Little Trade Lake Watershed**

#### **COARSE WOODY HABITAT (WOLTER, 2012)**

Coarse woody habitat (CWH) in lakes is classified as trees, limbs, branches, roots, and wood fragments at least 4 inches in diameter that enter a lake by natural (beaver activity, toppling from ice, wind, or wave scouring) or human means (logging, intentional habitat improvement, flooding following dam construction). CWH in the littoral or near-shore zone serves many functions within a lake ecosystem including erosion control, as a carbon source, and as a surface for algal growth which is an important food base for aquatic macro invertebrates. Presence of CWH has also been shown to prevent suspension of sediments, thereby improving water clarity. CWH serves as important refuge, foraging, and spawning habitat for fish, aquatic invertebrates, turtles, birds, and other animals. The amount of littoral CWH occurring naturally in lakes is related to characteristics of riparian forests and likelihood of toppling. However, humans have also had a large impact on amounts of littoral CWH present in lakes through time. During the 1800's the amount of CWH in northern lakes was increased beyond natural levels as a result of logging practices. But time changes in the logging industry and forest composition along with increasing shoreline development have led to reductions in CWH present in many northern Wisconsin lakes.

CWH is often removed by shoreline residents to improve aesthetics or select recreational opportunities (swimming and boating). Jennings et al. (2003) found a negative relationship between lakeshore development and the amount of CWH in northern Wisconsin lakes. Similarly, Christensen et al. (1996) found a negative correlation between density of cabins and CWH present in Wisconsin and Michigan lakes. While it is difficult to make precise determinations of natural densities of CWH in lakes it is believed that the value is likely on the scale of hundreds of logs per mile. The positive impact of CWH on fish communities have been well documented by researchers, making the loss of these habitats a critical concern. One study determined that black crappie selected nesting sites that were usually associated with woody debris, silty substrate, warmer water, and protected from wind and waves (Pope & Willis, 1997).

Fortunately, remediation of this habitat type is attainable on many waterbodies, particularly where private landowners and lake associations are willing to partner with county, state, and federal agencies. Large-scale CWH projects are currently being conducted by lake associations and local governments with assistance from the WDNR where hundreds of whole trees are added to the near-shore areas of lakes. For more information on this process visit: <http://dnr.wi.gov/topic/fishing/outreach/fishsticks.html> (last accessed on 12-29-2016).

Small-scale CWH projects, more commonly referred to as “fishsticks,” can also be done by individual property owners, and are eligible for grant assistance through the WDNR Healthy Lakes program. This program is intended to help individual property owners make a positive impact on their lake’s ecosystem through small-scale projects such as fishsticks (Figure 13).



**Figure 13: Coarse woody habitat-Fishsticks projects**

### **SHORELANDS**

How the shoreline of a lake is managed can have big impacts on the water quality and health of that lake. Natural shorelines prevent polluted runoff from entering lakes, help control flooding and erosion, provide fish and wildlife habitat, may make it harder for AIS to establish themselves, muffle noise from watercraft, and preserve privacy and natural scenic beauty. Many of the values lake front property owners appreciate and enjoy about their properties - natural scenic beauty, tranquility, privacy, relaxation - are enhanced and preserved with good shoreland management. And healthy lakes with good water quality translate into healthy lake front property values.

Shorelands may look peaceful, but they are actually the hotbed of activity on a lake. 90% of all living things found in lakes - from fish, to frogs, turtles, insects, birds, and other wildlife - are found along the shallow margins and shores. Many species rely on shorelands for all or part of their life cycles as a source for food, a place to sleep, cover from predators, and to raise their young. Shorelands and shallows are the spawning grounds for fish, nesting sites for birds, and where turtles lay their eggs. There can be as much as 500% more species diversity at the water's edge compared to adjoining uplands.

Lakes are buffered by shorelands that extend into and away from the lake. These shoreland buffers include shallow waters with submerged plants (like coontail and pondweeds), the water's edge where fallen trees and emergent plants like rushes might be found, and upward onto the land where different layers of plants (low ground cover, shrubs, trees) may lead to the lake. A lake's littoral zone is a term used to describe the shallow water area where aquatic plants can grow because sunlight can penetrate to the lake bottom. Shallow lakes might be composed entirely of a littoral zone. In deeper lakes, plants are limited where they can grow by how deeply light can penetrate the water.

Shorelands are critical to a lake's health. Activities such as replacing natural vegetation with lawns, clearing brush and trees, importing sand to make artificial beaches, and installing structures such as piers, can cause water quality decline and change what species can survive in the lake. In addition to being potentially damaging, some of these undertakings require permits and approval. Most changes to lakebed exposed by fluctuating water levels (removal of sediments, additions of beach sand, etc.), often require permits and approval. The only exceptions to this are manual removal of a 30 foot corridor of native plants or the removal of non-native invasive plants. These regulations have been put in place to encourage property owners to responsibly manage their shorelands to improve and maintain the quality of the lake as a whole.

## PROTECTING WATER QUALITY

Shoreland buffers slow down rain and snow melt (runoff). Runoff can add nutrients, sediments, and other pollutants into lakes, causing water quality declines. Slowing down runoff will help water soak (infiltrate) into the ground. Water that soaks into the ground is less likely to damage lake quality and recharges groundwater that supplies water to many of Wisconsin's lakes. Slowing down runoff water also reduces flooding, and stabilizes stream flows and lake levels.

Shoreland wetlands act like natural sponges trapping nutrients where nutrient-rich wetland sediments and soils support insects, frogs, and other small animals eaten by fish and wildlife.

Shoreland forests act as filters, retainers, and suppliers of nutrients and organic material to lakes. The tree canopy, young trees, shrubs, and forest understory all intercept precipitation, slowing runoff, and contributing to water infiltration by keeping the soil's organic surface layer well-aerated and moist. Forests also slow down water flowing overland, often capturing its sediment load before it can enter a lake or stream. In watersheds with a significant proportion of forest cover, the erosive force of spring snow melts is reduced as snow in forests melts later than snow on open land, and melt water flowing into streams is more evenly distributed. Shoreland trees grow, mature, and eventually fall into lakes where they protect shorelines from erosion, and are an important source of nutrients, minerals and wildlife habitat.

## NATURAL SHORELANDS ROLE IN PREVENTING AIS

In addition to removing essential habitat for fish and wildlife, clearing native plants from shorelines and shallow waters can open up opportunities for invasive species to take over. Like tilling a home garden to prepare it for seeding, clearing shoreland plants exposes bare earth and removes the existing competition (the cleared shoreland plants) from the area. Nature fills a vacuum. While the same native shoreland plants may recover and reclaim their old space, many invasive species possess "weedy" traits that enable them to quickly take advantage of new territory and out-compete natives.

The act of weeding creates continual disturbance, which in turn benefits plants that behave like weeds. The modern day practice of mowing lawns is an example of keeping an ecosystem in a constant state of disturbance to the benefit of invasive species like turf grass, dandelions, and clover, all native to Europe. Keeping shoreline intact is a good way to minimize disturbance and minimize opportunities for invasive species to gain a foothold.

## THREATS TO SHORELANDS

When a landowner develops a waterfront lot, many changes may take place including the addition of driveways, houses, decks, garages, sheds, piers, rafts and other structures, wells, septic systems, lawns, sandy beaches and more. Many of these changes result in the compaction of soil and the removal of trees and native plants, as well as the addition of impervious (hard) surfaces, all of which alter the path that precipitation takes to the water.

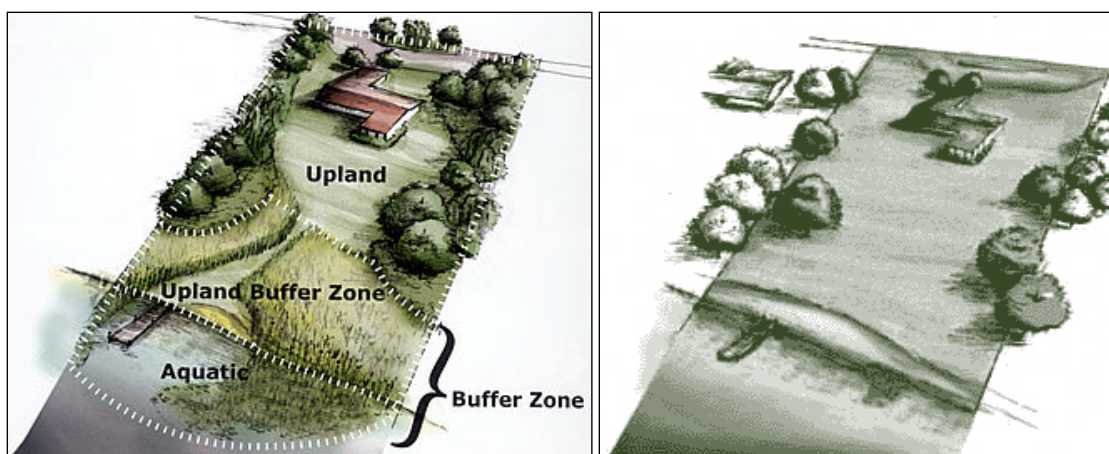


Building too close to the water, removing shoreland plants, and covering too much of a lake shore lot with hard surfaces (such as roofs and driveways) can harm important habitat for fish and wildlife, send more nutrient and sediment runoff into the lake, and cause water quality decline.

Changing one waterfront lot in this fashion may not result in a measurable change in the quality of the lake or stream. But cumulative effects when several or many lots are developed in a similar way can be enormous. A lake's response to stress depends on what condition the system is in to begin with, but bit by bit, the cumulative effects of tens of thousands of waterfront property owners "cleaning up" their shorelines, are destroying the shorelands that protect their lakes. Increasing shoreline development and development throughout the lake's watershed can have undesired cumulative effects.

#### SHORELAND PRESERVATION AND RESTORATION

If a native buffer of shoreland plants exists on a given property, it can be preserved and care taken to minimize impacts when future lake property projects are contemplated. If a shoreline has been altered, it can be restored. Shoreline restoration involves recreating buffer zones of natural plants and trees. Not only do quality wild shorelines create higher property values, but they bring many other values too. Some of these are aesthetic in nature, while others are essential to a healthy ecosystem. Healthy shorelines mean healthy fish populations, varied plant life, and the existence of the insects, invertebrates and amphibians which feed fish, birds and other creatures. Figure 14 shows the difference between a natural and unnatural shoreline adjacent to a lake home. More information about healthy shorelines can be found at the following website: <http://wisconsinlakes.org/index.php/shorelands-a-shallows> (last accessed 12-29-2016).



**Figure 14: Healthy, AIS Resistant Shoreland (left) vs. Shoreland in Poor Condition**

Most of the shoreline around Little Trade Lake is privately owned residential property. The western shore contains a large number of properties with heavily disturbed shorelines while most of the eastern shore properties have relatively undisturbed shoreline. On the western shore, most of the properties have manicured lawns mowed down to the lake. This is not good for the lake, but it is easily remedied with the installation of a native plant buffer which, if sponsored by RTLIA, could potentially be funded with WDNR Healthy Lakes Grants which are focused on helping individual property owners implement shoreline best management practices.



## AIS MANAGEMENT 2007-2016

EWM was first discovered in Little Trade Lake in 2009. CLP has been present in Little Trade Lake even longer than EWM. Most of the management in Little Trade Lake has been focused on EWM with CLP being treated at the same time, when it is contained within the designated EWM treatment areas. Table 4 provides a quick breakdown of all AIS management pertaining to EWM and CLP since 2007.

**Table 4: 2007-2017 Completed and Proposed AIS Management**

AIS Management on Little Trade Lake, 2007-2017											
Task	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
APM Plan					X					X	X
AIS Control Grant					X					X	X
AIS Rapid Response Grant											
Spring EWM Treatment (acres)						4.13	5.06		6.52	10.05	none
Fall EWM Bed Mapping					X	X	X	X	X	X	P
EWM Physical Removal						X	X	X	X	X	
CLP Bed Mapping					X	X	X	X	X	X	
Spring CLP Treatment (acres)						4.13	5.06		6.52	10.05	none
Pre-treatment Plant Survey					X	X	X	X	X		
Post Treatment Plant Survey					X	X	X		X		
Whole-lake PI Survey	X									X	
X= Completed, P=Proposed											

In this APM Plan, the management assessment completed focuses on EWM and CLP management completed or proposed between 2011 and 2017. The majority of CLP and EWM management in Little Trade Lake over this time period was managed using early season/spring small and large-scale herbicide application. Since 2013, several herbicide combinations have been used with mixed success. In 2013, both endothall and 2,4-D were applied to treated areas on the same day. This resulted significant reductions in CLP and EWM in every treatment area except the North Bay. In 2014, no treatment was completed due to high water. In 2015, only endothall was used as it was felt that if applied at a high enough concentration, endothall alone would kill both CLP and EWM. This was not the case, although CLP was well-controlled, EWM was not and recovered fully later in the 2015 season. As a result, endothall and 2,4-D were again combined and applied back to back in 2016, with outstanding results even through the fall EWM bed-mapping survey (Table 5) (Figure 15).

**Table 5 – 2013-2017 CLP and EWM Treatment Details**

Year	# of Beds	Total Area Treated (acres)	Range of Bed Size	Herbicide	Concentration	Results- AIS	Results- Native Plants
2013	14	5.14	0.03-2.34	Endothall (liquid) 2,4-D (granular)	2.0 ppm 3.0 ppm	CLP- significant decrease EWM- No effect in the North Bay, Significant decline elsewhere	Significant increase in species richness.
2014	No Treatment due to high water levels						
2015	6	6.52	0.07-5.46	Endothall (liquid) Endothall (granular)	2.5 ppm (North Bay) 3.0 ppm	CLP- significant decrease EWM- No effect	No significant changes
2016	11	10.05	0.13-3.63	Diquat (Reward) (North Bay) Endothall (liquid) 2,4-D (liquid)	NA 2.5 ppm 3.5ppm	Highly significant decrease in CLP and EWM in all treated areas	Significant decline in common waterweed, increases in several other species
2017	As a result of treatment success in 2016, no treatment occurred						

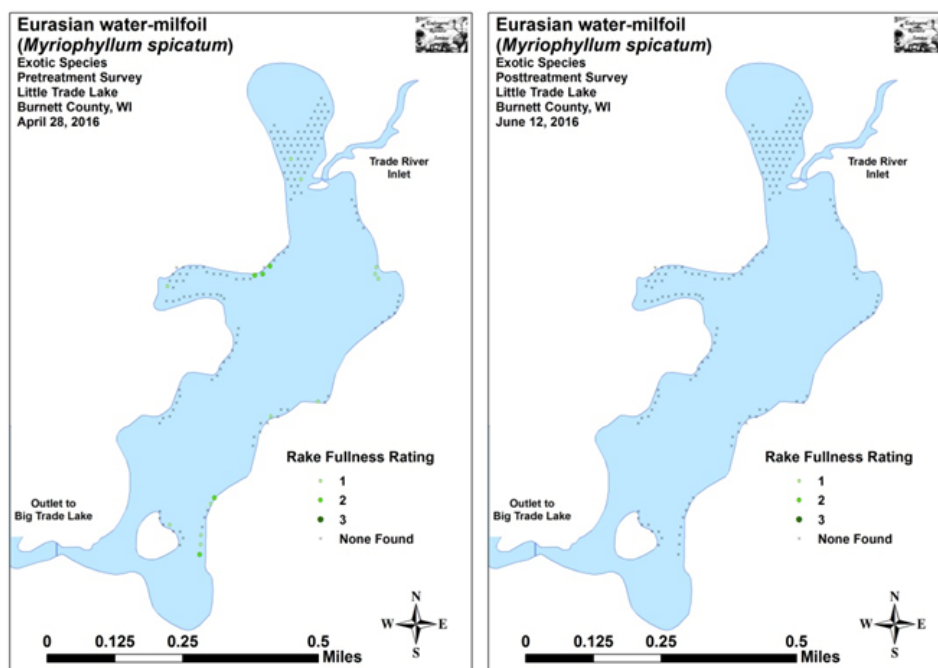


Figure 15- 2016 EWM treatment results in the north bay and remaining body of the lake

It was assumed that the lack of treatment success in the North Bay prior to 2016 was the result of inflow from the Trade River diluting or washing away the chosen herbicide before it had sufficient time to kill the target species. As a result, diquat, a faster acting contact herbicide was used and a dye study was included with the 2016 treatment in the North Bay to determine herbicide contact time and concentration. Rhodamine dye was applied with the herbicide and subsequent monitoring using a fluorimeter was completed. Multiple sites within the North Bay (Figure 16) were monitored at various times for 48 hours after application of the herbicide. Figure 17 shows the results of that dye study.

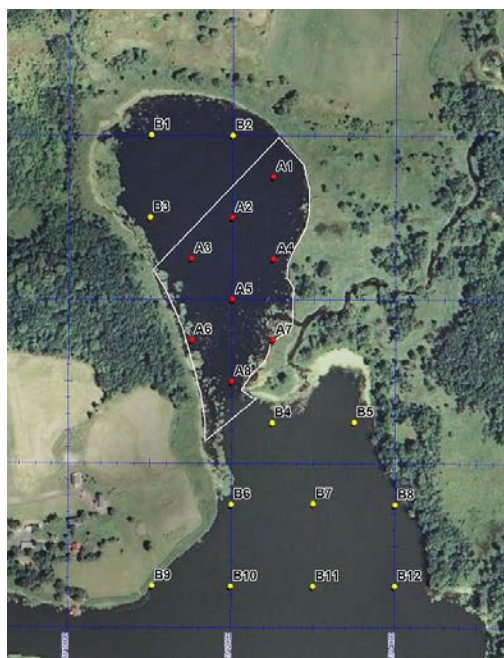


Figure 16 – 2016 Rhodamine Dye Testing Sites in the North Bay of Little Trade Lake

Points A5 and A6, along with several points near them where additional testing was completed were the only locations where the concentration of dye exceeded 10- $\mu\text{g/L}$ . All other sites remained at low concentrations, with dye simulation levels for all sites dropping below 10- $\mu\text{g/L}$  after 48 hours. Despite these results, the 2016 North Bay treatment was highly successful with significant reductions in CLP (Figure 18) and EWM (Figure 15) within the treated area that lasted through the fall 2016 EWM bed-mapping survey with only single stem remnants of the previous EWM identified. No EWM beds were identified during the fall survey; however several high density areas that only covered 0.34 acres in total were documented. All of the EWM plants found in the 2016 fall bed-mapping survey were removed by the plant survey technician.

Native aquatic plants were mostly unscathed, although common waterweed did experience a significant decline from 71 points with the plant pre-treatment, and only 50 points post-treatment. The mean density of all these points did not change from pre to post treatment.

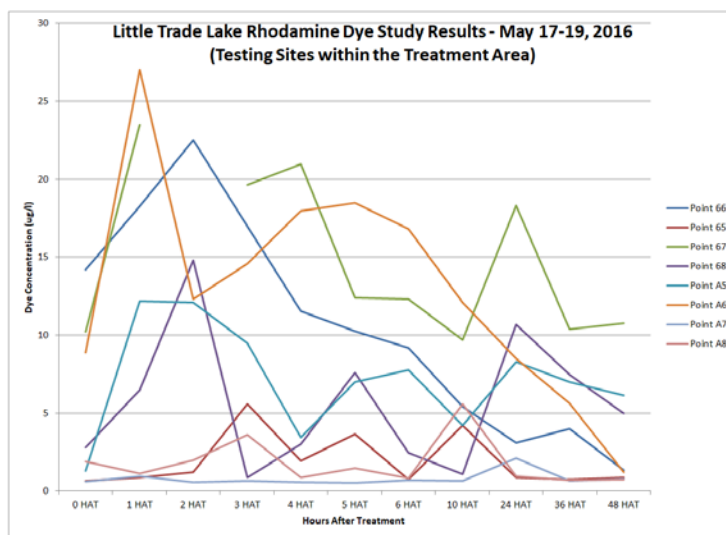


Figure 17 – Rhodamine Dye Testing Results from the North Bay of Little Trade Lake

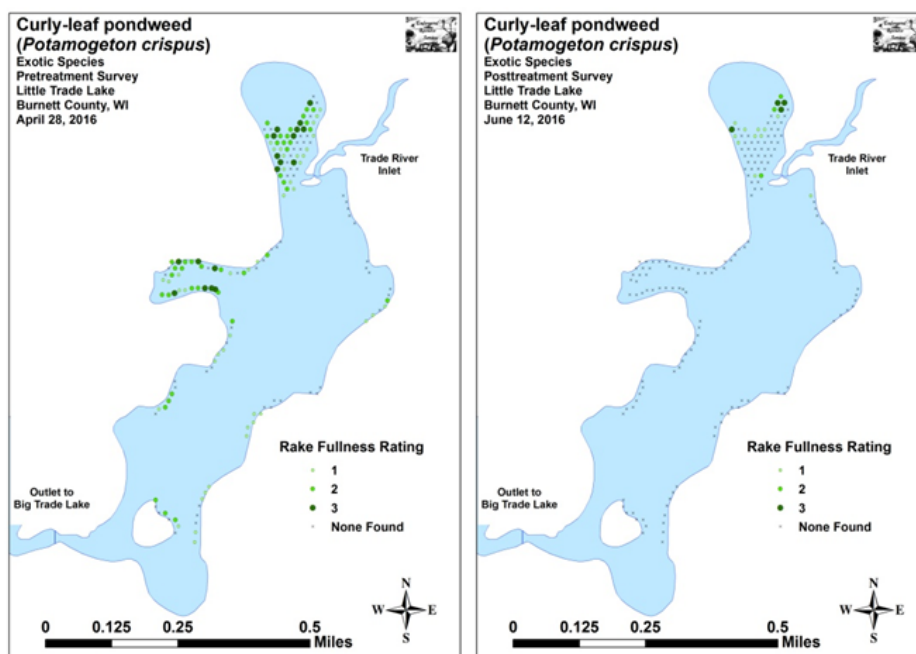


Figure 18 – 2016 CLP treatment results in the north bay and remaining body of the lake

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## 2009 AND 2016 WHOLE LAKE POINT INTERCEPT AQUATIC PLANT SURVEYS

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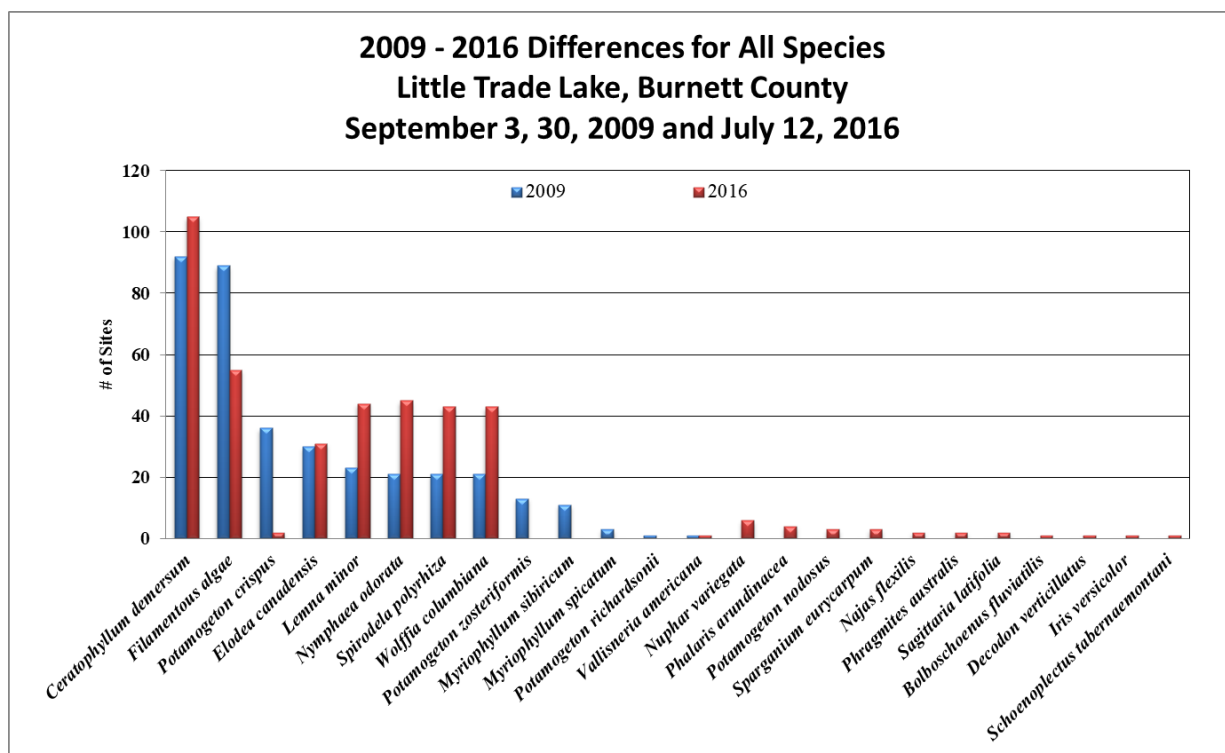
A prerequisite to updating the APMP for Little Trade Lake was to compare how the lake's vegetation had changed since the last point intercept survey. In 2009, a warm-water, whole-lake, point-intercept survey of aquatic plants was completed by the Polk County Land and Water Conservation Department. This survey was repeated in 2016 by Endangered Resource Sciences (ERS) on July 12. During the 2009 survey EWM was documented at three points with another eleven points having a visual record of the plant. In 2016, no points were identified with EWM during the summer survey, a testament to how well the 2016 combined early season EWM and CLP treatment worked. In both surveys the littoral or plant growing zone of the lake covers about 65 acres or 52% of the total surface area of the lake.

### WARM-WATER FULL POINT-INTERCEPT AQUATIC PLANT SURVEY

Plant survey statistics from 2009 and 2016 show some differences (Table 6). The biggest differences are in terms of the number of different plant species identified during the two surveys. The total number of species in 2016 is nearly double what it was in 2009 (Figure 19). The most likely reason for this change is the experience of the entity completing the survey. Likely related to the number of different species identified is the number of different species per site in all species per site parameters. With this explanation considered, when comparing aquatic plant species that were identified in both the 2009 and 2016 surveys, there is a greater number of points with these plants in 2016, then there were in 2009 with the exception of CLP and two other native species – flat-stem pondweed and northern watermilfoil. The number of points with CLP in 2016 is much less than in 2009 (Figure 19).

**Table 6 – 2009 (Polk County) and 2016 (ERS) Point-intercept Aquatic Plant Survey Statistics**

<b>SUMMARY STATS: Little Trade Lake 2009 &amp; 2016</b>	<b>2009</b>	<b>2016</b>
Total number of sites visited	329	336
Total number of sites with vegetation	115	114
Total number of sites shallower than maximum depth of plants	158	187
Frequency of occurrence at sites shallower than maximum depth of plants	72.78	60.96
Simpson Diversity Index	0.83	0.83
Maximum depth of plants (ft)**	8.00	10.50
Number of sites sampled using rake on Rope (R)	0	0
Number of sites sampled using rake on Pole (P)	174	293
Average number of all species per site (shallower than max depth)	1.73	1.82
Average number of all species per site (veg. sites only)	2.37	2.98
Average number of native species per site (shallower than max depth)	1.48	1.79
Average number of native species per site (veg. sites only)	2.11	2.96
Species Richness	12	19
Species Richness (including visuals)	12	21
Species Richness (including visuals and boat survey)	12	24
Mean depth of plants (ft)	3.46	4.30
Median depth of plants (ft)	3.00	4.00
Mean rake fullness (veg. sites only)	ND	2.04



**Figure 19 – Changes in aquatic plant species identified during the 2009 and 2016 Point-intercept Aquatic Plant Surveys**

Three measurements of the health of the aquatic plant community outside of these survey statistics are the Simpson's Diversity Index (SDI), Floristic Quality Index (FQI), and Coefficient of Conservatism.

#### SIMPSON'S DIVERSITY INDEX:

A diversity index allows the entire plant community at one location to be compared to the entire plant community at another location. It also allows the plant community at a single location to be compared over time thus allowing a measure of community degradation or restoration at that site. With Simpson's Diversity Index, the index value represents the probability that two individual plants (randomly selected) will be different species. The index values range from 0 -1 where 0 indicates that all the plants sampled are the same species to 1 where none of the plants sampled are the same species. The greater the index value, the higher the diversity in a given location. Although many natural variables like lake size, depth, dissolved minerals, water clarity, mean temperature, etc. can affect diversity, in general, a more diverse lake indicates a healthier ecosystem. Perhaps most importantly, plant communities with high diversity also tend to be more resistant to invasion by exotic species.

The SDI in 2009 was 0.83. In 2016 the value remained the same at 0.83. These values are similar to Long Trade Lake, also in the Trade River system, and fairly average for similar lakes in the area. For example, Upper Vermillion Lake in Barron County (about 100 acres in size) has an average depth of about 9-ft. It has a SDI of 0.81. Upper Vermillion Lake also has a large population of CLP, like Little Trade Lake. 2016 plant survey statistics for Little Trade, Long Trade, and Upper Vermillion lakes are shown in Table 7.

#### FLORISTIC QUALITY INDEX (FQI)

This index measures the impact of human development on a lake's aquatic plants. The 124 species in the index are assigned a Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned,

the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and they often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each native index species found in the lake during the point-intercept survey, and multiplying it by the square root of the total number of plant species (N) in the lake. Statistically speaking, the higher the index value, the healthier the lake's aquatic plant community is assumed to be. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, North Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Long Trade Lake is in the North Central Hardwood Forests Ecoregion.

In 2009, a total of 10 native index species were identified in the lake during the point-intercept survey. They produced a mean C of 4.9 and a FQI of 15.5. In 2016, a total of 15 native index plants were identified in the lake during the point-intercept survey. They produced a mean C of 4.7 and a FQI of 18.3. Nichols (1999) reported an average mean C for the North Central Hardwood Forests Region of 5.6 putting Little Trade Lake below average for this part of the state. The FQI was just slightly below the median FQI of 20.9 for the North Central Hardwood Forests (Nichols 1999).

2016 values for the FQI and C for Little Trade Lake, Long Trade Lake, and Upper Vermillion Lake are included in Table 7.

Overall, the aquatic plant community in Little Trade Lake appears to be about the same in 2016 as it was in 2009. The amount of CLP is less than it was in 2009, and the amount of EWM is down significantly from where it was in 2009. Flat-stem pondweed and northern watermilfoil were two native aquatic plant species that experienced declines in the number of points they were present at, but overall density remained the same. Several other species including white water lily, small pondweed, spatterdock (yellow lily), and very small floating plants including small and large duckweed and common watermeal saw moderate to highly significant increases. The amount of filamentous algae also decreased from 2009 to 2016 (Figure 19).

**Table 7 - 2016 Aquatic Plant Survey Statistics for Little Trade Lake and Long Trade Lake, Polk County; and Upper Vermillion Lake, Barron County**

<b>Summary Statistics Comparison: Little Trade, Long Trade, and Upper Vermillion Lakes</b>	<b>2016 Little Trade</b>	<b>2016 Long Trade</b>	<b>2016 Up. Vermillion</b>
Total number of sites visited	336	376	286
Total number of sites with vegetation	114	79	182
Total number of sites shallower than maximum depth of plants	187	125	270
Frequency of occurrence at sites shallower than maximum depth of plants	60.96	63.20	67.41
Simpson Diversity Index	0.83	0.87	0.81
Maximum depth of plants (ft)**	10.50	7.50	8.00
Average number of all species per site (shallower than max depth)	1.82	2.22	1.87
Average number of all species per site (veg. sites only)	2.98	3.53	2.77
Average number of native species per site (shallower than max depth)	1.79	2.15	1.84
Average number of native species per site (veg. sites only)	2.96	3.55	2.74
Species Richness	19	24	14
Species Richness (including visuals)	21	26	19
Species Richness (including visuals and boat survey)	24	30	25
Mean Coefficient of Conservatism (Mean C)	4.70	4.90	4.80
Floristic Quality Index	18.30	22.00	16.70
Mean rake fullness (veg. sites only)	2.04	2.28	2.32



## WILD RICE

According to the Great Lakes Indian Fish and Wildlife Commission (GLIFWC), Long Trade, Round, Little Trade and Big Trade lakes are not wild rice waters. Additionally, wild rice was not found during the aquatic plant surveys of the lakes or during the Sensitive Areas survey. Although wild rice is not present in these lakes, it warrants attention due to its ecologic and cultural significance and its abundance in nearby lakes and streams (for example, the Grettum Flowage, Rice Lake, Spirit Lake, and the Clam Lakes). Any activity included in a comprehensive lake or aquatic plant management plan that could potentially impact the growth of wild rice in any body of water that has in the past, currently has, or potentially could have wild rice in the future requires consultation with the Tribal Nations. This consultation is completed by the Department of Natural Resources during their review of lake management documents. When present in a lake, wild rice is afforded numerous protections due to its ecological and cultural significance and management is therefore focused on harvest goals and protection rather than removal.

Wild rice is an annual aquatic grass that produces seed that is a nutritious source of food for wildlife and people (Figure 20). As a native food crop, it has a tremendous amount of cultural significance to the Wisconsin and Minnesota Native American Nations. Wild rice pulls large amounts of nutrients from the sediment in a single year and the stalks provide a place for filamentous algae and other small macrophytes to attach and grow. These small macrophytes pull phosphorous in its dissolved state directly from the water. Wild rice can benefit water quality, provide habitat for wildlife, and help minimize substrate re-suspension and shoreland erosion.

In Wisconsin, wild rice has historically ranged throughout the state. Declines in historic wild rice beds have occurred statewide due to many factors, including dams, pollution, large boat wakes, and invasive plant species. Renewed interest in the wild rice community has led to large-scale restoration efforts to reintroduce wild rice in Wisconsin's landscape. There is the potential for planting wild rice at shoreline restoration and rehabilitation sites in the Trade Lakes system however this should not be done without full constituent support as the presence of wild rice will limit certain aquatic plant management actions. Extensive information is available on wild rice from GLIFWC and the WDNR.



**Figure 20 - Wild Rice on Clam Lake in Burnett County (Photos by John Haack)**

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## AQUATIC INVASIVE SPECIES (AIS)

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Past invasive species monitoring efforts have identified several different plant non-native, invasive species in Little Trade Lake. Most of these species are considered aquatic, although some are also considered shoreland or wetland type invasive species.

### NON-NATIVE, AQUATIC INVASIVE PLANT SPECIES

Eurasian watermilfoil (EWM) and curly-leaf pondweed (CLP) are the most problematic invasive species found in Long Trade Lake. In addition purple loosestrife and reed canary grass have been identified along the shores of Long Trade Lake. Purple loosestrife and reed canary grass are shoreland or wetland plants not generally problematic within the lake, but can be very problematic on the shores and in the wetlands adjacent to the lake. More information is given for each non-native species in the following sections.

#### EWM

EWM is a submersed aquatic plant native to Europe, Asia, and northern Africa (Figure 21). It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, EWM is difficult to distinguish from Northern water milfoil. EWM has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

EWM grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

Unlike many other plants, EWM does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. EWM is readily dispersed by boats, motors, trailers, bilges, live wells, and bait buckets; and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, EWM is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of EWM provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of EWM also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets



the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by EWM may lead to deteriorating water quality and algae blooms in infested lakes.



**Figure 21: EWM**

In 1995, some of the EWM in Long Trade Lake, a few miles upstream of Little Trade Lake, was found to be a hybrid of EWM and the native, Northern watermilfoil (NWM). This hybrid milfoil is believed to be less sensitive to chemical management than the parental strands which can make management much more difficult (LaRue, Zuelling, & Thum, 2012). Currently, the milfoil present in Long Trade Lake is considered regular EWM, as hybrid EWM has not been identified for many years. The EWM in Little Trade Lake is considered not to be hybrid. There is still regular EWM in Little Trade Lake which needs to be managed.

#### CURLY-LEAF PONDWEED

Curly-leaf pondweed (CLP) has been identified throughout Little Trade Lake. Early in the season, most of the littoral zone is overrun by large beds of CLP which choke out native vegetation and can create large algae blooms later in the season.

CLP is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia (Figure 22). It was accidentally introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. CLP is commonly found in alkaline and high nutrient waters, preferring soft substrate and shallow water depths. It tolerates low light and low water temperatures. It has been reported in all of the lower 48 states.

CLP spreads through burr-like winter buds (turions) (Figure 22), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making curly-leaf pondweed one of the first nuisance aquatic plants to emerge in the spring. It becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and out-compete native plants in the spring. In mid-summer, when most aquatic plants are growing, CLP plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients which contribute to algal blooms, as well as create unpleasant stinking messes on beaches. CLP forms surface mats that interfere with aquatic recreation.



**Figure 22: CLP Plants and Turions**

## PURPLE LOOSESTRIFE

Purple loosestrife (Figure 23) is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers that vary from purple to magenta possess 5-6 petals aggregated into numerous long spikes, and bloom from August to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat. By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, more than 20 states, including Wisconsin have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. Low densities in most areas of the state suggest that the plant is still in the pioneering stage of establishment. Areas of heaviest infestation are sections of the Wisconsin River, the extreme southeastern part of the state, and the Wolf and Fox River drainage systems.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

Purple loosestrife can germinate successfully on substrates with a wide range of pH. Optimum substrates for growth are moist soils of neutral to slightly acidic pH, but it can exist in a wide range of soil types. Most seedling establishment occurs in late spring and early summer when temperatures are high.

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 2 meters high and produce more than two

million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local perturbation is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. Plants may be quite large and several years old before they begin flowering. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. Invasion usually begins with a few pioneering plants that build up a large seed bank in the soil for several years. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland. The plant can also make morphological adjustments to accommodate changes in the immediate environment; for example, a decrease in light level will trigger a change in leaf morphology. The plant's ability to adjust to a wide range of environmental conditions gives it a competitive advantage; coupled with its reproductive strategy, purple loosestrife tends to create monotypic stands that reduce biotic diversity. Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways.

Purple loosestrife has been identified around Little Trade Lake.



**Figure 23: Purple Loosestrife**

#### REED CANARY GRASS

Reed canary grass (Figure 24) is a large, coarse grass that reaches 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3 1/2 to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The leaf ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.



Both Eurasian and native ecotypes of reed canary grass are thought to exist in the U.S. The Eurasian variety is considered more aggressive, but no reliable method exists to tell the ecotypes apart. It is believed that the vast majority of our reed canary grass is derived from the Eurasian ecotype. Agricultural cultivars of the grass are widely planted.

Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands.

Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas; it also grows in disturbed areas such as berms and spoil piles.

Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring and then spreads laterally. Growth peaks in mid-June and declines in mid-August. A second growth spurt occurs in the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

This species prefers disturbed areas, but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in just a few years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, and deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites.

Reed canary grass is found within the wetland along the northern shoreline of Little Trade Lake. Currently, this population is fairly limited and has not yet become a nuisance within the wetland. This is good, but reed canary grass should still be a part of the AIS monitoring effort on Little Trade Lake to prevent this vital wetland from becoming a monoculture.



**Figure 24: Reed Canary Grass**

## NON-NATIVE AQUATIC INVASIVE ANIMAL SPECIES

Currently there are no non-native animal species that have established verified populations within Little Trade Lake. However some have been found in several lakes close to Little Trade Lake, and two species, rusty crayfish and Chinese mystery snails, have been found within the Trade River.

### CHINESE MYSTERY SNAILS

Chinese mystery snails and banded mystery snails have not been identified within Little Trade Lake. Chinese mystery snails have been found in the Trade River between Long Trade Lake and Round Lake. Both varieties of snail have been found within Big Butternut Lake which is within the Little Trade Lake watershed.

The Chinese mystery snails and the banded mystery snails (Figure 25) are non-native snails that have been found in a number of Wisconsin lakes. There is not a lot yet known about these species, however, it appears that they have a negative effect on native snail populations. The mystery snail's large size and hard operculum (a trap door cover which protects the soft flesh inside), and their thick hard shell make them less edible by predators.

The female mystery snail gives birth to live crawling young. This may be an important factor in their spread as it only takes one impregnated snail to start a new population. Mystery snails thrive in silt and mud areas although they can be found in lesser numbers in areas with sand or rock substrates. They are found in lakes, ponds, irrigation ditches, and slower portions of streams and rivers. They are tolerant of pollution and often thrive in stagnant water areas. Mystery snails can be found in water depths of 0.5 to 5 meters (1.5 to 15 feet). They tend to reach their maximum population densities around 1-2 meters (3-6 feet) of water depth. Mystery snails do not eat plants. Instead, they feed on detritus and in lesser amounts on algae and phytoplankton. Thus removal of plants along the shoreline area will not reduce the abundance of mystery snails.

Lakes with high densities of mystery snails often see large die-offs of the snails. These die-offs are related to the lake's warming coupled with low oxygen (related to algal blooms). Mystery snails cannot tolerate low oxygen levels. High temperatures by themselves seem insufficient to kill the snails as the snails could move into deeper water.

Many lake residents are worried about mystery snails being carriers of the swimmer's itch parasite. In theory they are potential carriers, however, because they are an introduced species and did not evolve as part of the lake ecosystem, they are less likely to harbor the swimmer's itch parasites.



**Figure 25: Chinese Mystery Snails**

## RUSTY CRAYFISH

There is not a verified population of rusty crayfish within Little Trade Lake, but they are found along the entire length of the Trade River. While this does not mean there is a guaranteed population of rusty crayfish within Little Trade Lake, it does increase the likelihood of a population being present.

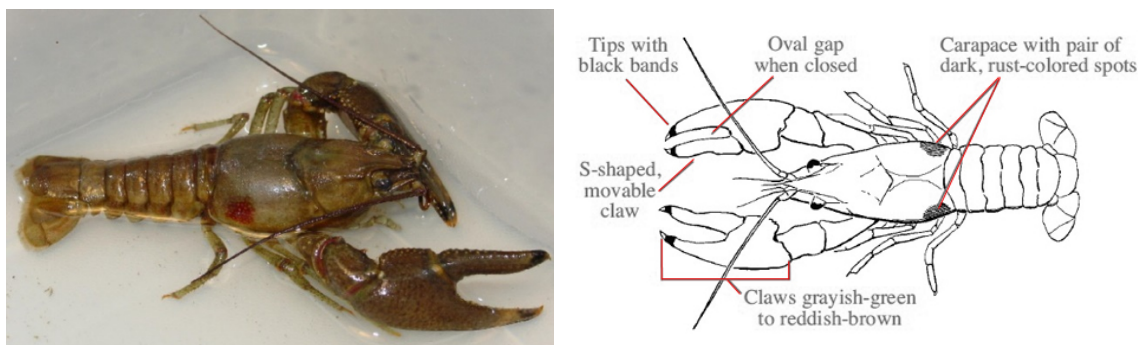
Rusty crayfish (Figure 26) live in lakes, ponds and streams, preferring areas with rocks, logs and other debris in water bodies with clay, silt, sand or rocky bottoms. They typically inhabit permanent pools and fast moving streams of fresh, nutrient-rich water. Adults reach a maximum length of 4 inches. Males are larger than females upon maturity and both sexes have larger, heartier, claws than most native crayfish. Dark “rusty” spots are usually apparent on either side of the carapace, but are not always present in all populations. Claws are generally smooth, with grayish-green to reddish-brown coloration. Adults are opportunistic feeders, feeding upon aquatic plants, benthic invertebrates, detritus, juvenile fish and fish eggs.

The native range of the rusty crayfish includes Ohio, Tennessee, Kentucky, Indiana, Illinois and the entire Ohio River basin. However, this species may now be found in Michigan, Massachusetts, Missouri, Iowa, Minnesota, New York, New Jersey, Pennsylvania, Wisconsin, New Mexico and the entire New England state area (except Rhode Island). The Rusty crayfish has been a reported invader since at least the 1930’s. Its further spread is of great concern since the prior areas of invasion have led to severe impacts on native flora and fauna. It is thought to have spread by means of released game fish bait and/or from aquarium release. Rusty crayfish are also raised for commercial and biological harvest.

Rusty crayfish reduce the amount and types of aquatic plants, invertebrate populations, and some fish populations--especially bluegill, smallmouth and largemouth bass, lake trout and walleye. They deprive native fish of their prey and cover and out-compete native crayfish. Rusty crayfish will also attack the feet of swimmers. On the positive side, rusty crayfish can be a food source for larger game fish and are commercially harvested for human consumption.

Rusty crayfish may be controlled by restoring predators like bass and sunfish populations. Preventing further introduction is important and may be accomplished by educating anglers, trappers, bait dealers and science teachers of their hazards. Use of chemical pesticides is an option, but does not target this species and will kill other aquatic organisms.

It is illegal to possess both live crayfish and angling equipment simultaneously on any inland Wisconsin water (except the Mississippi River). It is also illegal to release crayfish into a water of the state without a permit.



**Figure 26: Rusty Crayfish and identifying characteristics**

## ZEBRA MUSSELS

Zebra mussels (Figure 27) are an invasive species that have inhabited Wisconsin waters and are displacing native species, disrupting ecosystems, and affecting citizens' livelihoods and quality of life. They hamper

boating, swimming, fishing, hunting, hiking, and other recreation, and take an economic toll on commercial, agricultural, forestry, and aquacultural resources. The zebra mussel is a tiny (1/8-inch to 2-inch) bottom-dwelling clam native to Europe and Asia. Zebra mussels were introduced into the Great Lakes in 1985 or 1986, and have been spreading throughout them since that time. They were most likely brought to North America as larvae in ballast water of ships that traveled from fresh-water Eurasian ports to the Great Lakes. Zebra mussels look like small clams with a yellowish or brownish D-shaped shell, usually with alternating dark- and light-colored stripes. They can be up to two inches long, but most are under an inch. Zebra mussels usually grow in clusters containing numerous individuals.

Zebra mussels feed by drawing water into their bodies and filtering out most of the suspended microscopic plants, animals and debris for food. This process can lead to increased water clarity and a depleted food supply for other aquatic organisms, including fish. The higher light penetration fosters growth of rooted aquatic plants which, although creating more habitat for small fish, may inhibit the larger, predatory fish from finding their food. This thicker plant growth can also interfere with boaters, anglers and swimmers. Zebra mussel infestations may also promote the growth of blue-green algae, since they avoid consuming this type of algae but not others.

Zebra mussels attach to the shells of native mussels in great masses, effectively smothering them. A survey by the Army Corps of Engineers in the East Channel of the Mississippi River at Prairie du Chien revealed a substantial reduction in the diversity and density of native mussels due to Zebra Mussel infestations. The East Channel provides habitat for one of the best mussel beds in the Upper Mississippi River. Future efforts are being considered to relocate such native mussel beds to waters that are less likely to be impacted by zebra mussels.

Once zebra mussels are established in a water body, very little can be done to control them. It is therefore crucial to take all possible measures to prevent their introduction in the first place. Some of the preventative and physical control measures include physical removal, industrial vacuums, and back flushing.

Chemical applications include solutions of chlorine, bromine, potassium permanganate and even oxygen deprivation. An ozonation process is under investigation (patented by Bollyky Associates Inc.) which involves the pumping of high concentrations of dissolved ozone into the intake of raw water pipes. This method only works in controlling veligers, and supposedly has little negative impacts on the ecosystem. Further research on effective industrial control measures that minimize negative impacts on ecosystem health is needed.

In the fall of 2016, zebra mussels were found in a northwest Wisconsin lake for the first time. With this discovery, it increases the likelihood that zebra mussels will spread faster throughout northwest Wisconsin.

Zebra mussels have not been identified in Little Trade Lake. Little Trade Lake is not specifically listed in the Smart Prevention database, but Big Trade Lake is listed as suitable. This means it is very likely that Little Trade Lake would also be considered suitable, so a zebra mussel population could become established if they were introduced to the system.



**Figure 27: Zebra Mussels**

#### **AIS PREVENTION STRATEGY**

Little Trade Lake already has several established AIS. However there are many more that could be introduced to the lake. While there is no public boat landing on Little Trade Lake, the two that are on Big Trade Lake give the general public access to Little Trade Lake. The RTLIA will continue to do watercraft inspection and AIS signage at these access points. Both of these programs will follow UW-Extension Lakes and WDNR protocol through the Clean Boats, Clean Waters program and the Citizen Lake Monitoring Network AIS Monitoring program.

Additionally, having educated and informed lake residents is the best way to keep non-native AIS at bay in Little Trade Lake. To foster this, the RTLIA will host and/or sponsor lake community events including AIS identification and management workshops; distribute education and information materials to lake property owners and lake users through the newsletter, webpage, and general mailings.



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## MANAGEMENT ALTERNATIVES

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Nuisance aquatic plants can be managed a variety of ways in Wisconsin. The best management strategy will be different for each lake and depends on which nuisance species needs to be controlled, how widespread the problem is, and the other plants and wildlife in the lake. In many cases, an integrated pest management (IPM) approach to aquatic plant management that utilizes a number of control methods is necessary. The eradication of non-native aquatic invasive plant species such as EWM is generally not feasible, but preventing them from becoming a more significant problem is an attainable goal. It is important to remember however, that regardless of the plant species targeted for control, sometimes no manipulation of the aquatic plant community is the best management option. Plant management activities can be disruptive to a lake ecosystem and should not be done unless it can be shown they will be beneficial and occur with minimal negative ecological impacts.

Management alternatives for nuisance aquatic plants can be grouped into four broad categories: manual and mechanical removal, chemical application, biological control, and physical habitat alteration. Manual and mechanical removal methods include pulling, cutting, raking, harvesting, suction harvesting, and other means of removing the physical plant from the water and in most cases will require a WDNR permit. Chemical application is typified by the use of herbicides that kill or impede the growth of the aquatic plant and always requires a WDNR permit. Biological control methods include organisms that use the plant for a food source or parasitic organisms that use the plant as a host, killing or weakening it. Biological control may also include the use of species that compete successfully with the nuisance species for available resources. This activity may require a WDNR permit. Physical habitat alteration includes dredging, installing lake-bottom covers, manipulating light penetration, flooding, and drawdown. These activities may require permits under the WDNR waterways and wetlands program. It may also include making changes to or in the watershed of a body of water to reduce nutrients going in.

Each of the above control categories are regulated by the WDNR and most activities require a permit from the WDNR to implement. Mechanical harvesting of aquatic plants and under certain circumstances, physical removal of aquatic plants, is regulated under Wisconsin Administrative Rule NR 109 (Appendix B). The use of chemicals and biological controls are regulated under Administrative Rule NR 107 (Appendix C). Certain habitat altering techniques like the installation of bottom covers and dredging require a Chapter 30/31 waterway protection permit. In addition, anytime wild rice is involved one or more of these permits will be required.

Informed decision-making on aquatic plant management implementation requires an understanding of plant management alternatives and how appropriate and acceptable each alternative is for a given lake. The following sections list scientifically recognized and approved alternatives for controlling aquatic vegetation.

### NO MANAGEMENT

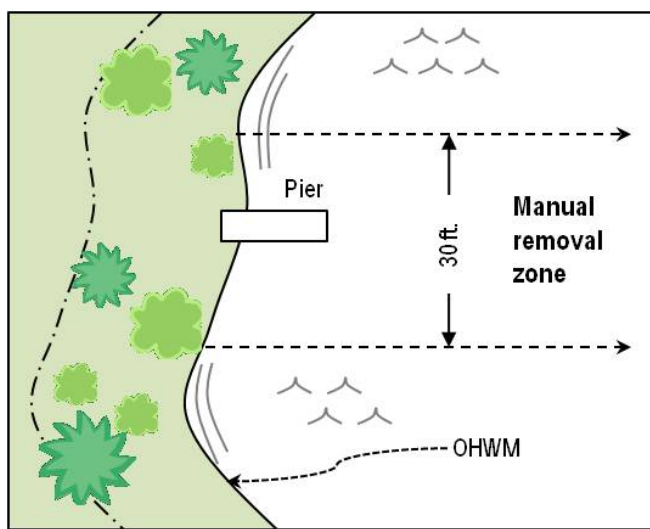
When evaluating the various management techniques, the assumption is erroneously made that doing nothing is environmentally neutral. In dealing with nonnative species like EWM, the environmental consequences of doing nothing may be high, possibly even higher than any of the effects of management techniques. Unmanaged, these species can have severe negative effects on water quality, native plant distribution, abundance and diversity, and the abundance and diversity of aquatic insects and fish (Madsen, 1997). Nonindigenous aquatic plants are the problem, and the management techniques are the collective solution. Nonnative plants are a biological pollutant that increases geometrically, a pollutant with a very long residence time and the potential to "biomagnify" in lakes, rivers, and wetlands (Madsen, 2000).

Foregoing any management of AIS in Little Trade Lake is not a recommended option. To keep CLP and EWM from causing greater harm, AIS management will continue to be implemented.

## HAND-PULLING/MANUAL REMOVAL

Manual or physical removal of aquatic plants by means of a hand-held rake or cutting implement; or by pulling the plants from the lake bottom by hand is allowed by the WDNR without a permit per NR 109.06 Waivers under the following conditions:

- Removal of native plants is limited to a single area with a maximum width of no more than 30 feet measured along the shoreline provided that any piers, boatlifts, swim rafts and other recreational and water use devices are located within that 30-foot wide zone and may not be in a new area or additional to an area where plants are controlled by another method (Figure 28)
- Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 is performed in a manner that does not harm the native aquatic plant community
- Removal of dislodged aquatic plants that drift on-shore and accumulate along the waterfront is completed.
- The area of removal is not located in a sensitive area as defined by the department under s. NR 107.05 (3) (i) 1, or in an area known to contain threatened or endangered resources or floating bogs
- Removal does not interfere with the rights of other riparian owners
- If wild rice is involved, the procedures of s. NR 19.09 (1)) are followed.



**Figure 28: Aquatic vegetation manual removal zone**

Although up to 30 feet of aquatic vegetation can be removed, removal should only be done to the extent necessary. There is no limit as to how far out into the lake the 30-ft zone can extend, however clearing large swaths of aquatic plants not only disrupts lake habits, it also creates open areas for non-native species to establish. Physical removal of aquatic plants requires a permit if the removal area is located in a “sensitive” or critical habitat area previously designated by the WDNR. Manual or physical removal can be effective at controlling individual plants or small areas of plant growth. It limits disturbance to the lake bottom, is inexpensive, and can be practiced by many lake residents. In shallow, hard bottom areas of a lake, or where impacts to fish spawning habitat need to be minimized, this is the best form of control. If water clarity in a body of water is such that aquatic plants can be seen in deeper water, pulling AIS while snorkeling or scuba diving is also allowable without a permit according to the conditions in NR 106.06(2) and can be effective at slowing the spread of a new AIS infestation within a lake when done properly.

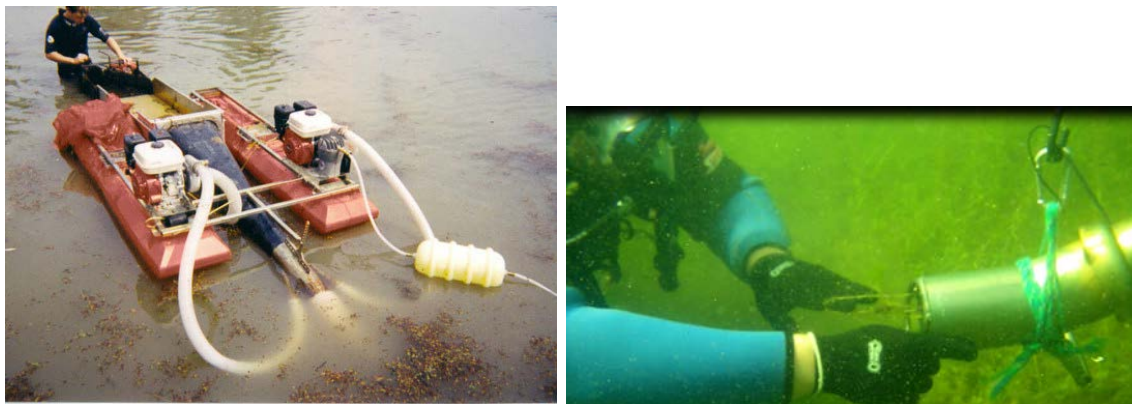
Larger scale hand or diver removal projects have had positive impacts in temporarily reducing or controlling AIS. Typically hand or diver removal is used when AIS has been newly identified and still exists as single plants or isolated small beds, but at least in one lake in New York State, it was used as a means to control a large-scale infestation of EWM. Kelting and Laxson (2010) reported that from 2004 to 2006 an “intensive

management effort” which involved “the selective removal of Eurasian water milfoil using diver hand harvesting of the entire littoral zone of the lake at least twice each summer for three years” followed by three years of maintenance management successfully reduced the overall distribution of EWM in the lake.

In some areas of Little Trade Lake, EWM and CLP may be best managed by hand-pulling/manual removal. However it is not suitable to manage all of the AIS in the lake this way. A renewed effort to continue to teach property owners to identify, and then physically remove EWM and CLP growing in the lake near their property is included as an activity in this plan. The RTLIA will work with residents on the lake to teach them how to identify EWM and how to properly remove it from around their docks and in their swimming areas.

#### **DIVER ASSISTED SUCTION HARVESTING**

Diver assisted suction harvesting or DASH, as it is often called, is a fairly recent aquatic plant removal technique. It is called "harvesting" rather than "dredging" because, although a specialized small-scale dredge is used, bottom sediment is not removed from the system. The operation involves hand-pulling of the target plants from the lake bed and inserting them into an underwater vacuum system that sucks up plants and their root systems taking them to the surface. It requires water pumps on the surface (generally on a pontoon system) to move a large volume of water to maintain adequate suction of materials that the divers are processing (Figure 29). Only clean water goes through the pump. The material placed by the divers into the suction hose along with the water is deposited into mesh bags on the surface with the water leaving through the holes in the bag. The bags have a large enough 'mesh' size so that silts, clay, leaves and other plant material being collected do not immediately clog them and block water movement. If a fish or other living marine life is sucked into the suction hose it comes out the discharge unharmed and is returned to the body of water. It can have some negative impacts to other nearby non-target plants if not done carefully, particularly those plants that are perennials and expand their populations by sub-sediment runners (Eichler, Bombard, Sutherland, & Boylen, Suction harvesting of Eurasian watermilfoil and its effect on native plant communities, 1993).



**Figure 29: DASH - Diver Assisted Suction Harvest (Aquacleaner Environmental, <http://www.aquacleaner.com/index.html>); Many Waters, LLC)**

DASH is not currently a feasible management option within Little Trade Lake. The main reason for this is simply that it is unlikely that a DASH unit would be able to access Little Trade Lake under the bridge between the two lakes. If, at some point a public access is established on Little Trade, DASH may become a more desirable management alternative.

## MECHANICAL REMOVAL

Mechanical management involves the use of devices not solely powered by human means to aid removal. This includes gas and electric motors, ATV's, boats, tractors, etc. Using these instruments to pull, cut, grind, or rotovate aquatic plants is illegal in Wisconsin without a permit. DASH is also considered mechanical removal. To implement mechanical removal of aquatic plants a Mechanical/Manual Aquatic Plant Control Application is required annually. The application is reviewed by the WDNR and other entities and a permit awarded if required criteria are met. Using repeated mechanical disturbance such as bottom rollers or sweepers can be effective at control in small areas, but in Wisconsin these devices are illegal and generally not permitted.

### LARGE-SCALE MECHANICAL HARVESTING

Large-scale mechanical harvesting is more traditionally used for control of CLP, but can be an effective way to reduce EWM biomass in a water body. It is typically used to open up channels through existing beds of EWM to improve access for both human related activities like boating, and natural activities like fish distribution and mobility on lakes in maintenance mode where EWM is well-established and restoration efforts have been discontinued.

Aquatic plant harvesters are floating machines that cut and remove vegetation from the water. The size and harvesting capabilities of these machines vary greatly. As they move, harvesters cut a swath of aquatic plants that is between 4 and 20 feet wide, and can be up to 10 feet deep. The on-board storage capacity of a harvester ranges from 100 to 1,000 cubic feet (by volume) or 1 to 8 tons (by weight). Most harvesters can cut between 2 and 8 acres of aquatic vegetation per day, and the average lifetime of a mechanical harvester is 10 years.

Mechanical harvesting of aquatic plants presents both positive and negative consequences to any lake. Its results - open water and accessible boat lanes - are immediate, and can be enjoyed without the restrictions on lake use which follow herbicide treatments. In addition to the human use benefits, the clearing of thick aquatic plant beds may also increase the growth and survival of some fish. By eliminating the upper canopy, harvesting reduces the shading caused by aquatic plants. The nutrients stored in the plants are also removed from the lake, and the sedimentation that would normally occur as a result of the decay of this plant matter is prevented. Additionally, repeated harvesting may result in thinner, more scattered growth.

Aside from the obvious effort and expense of harvesting aquatic plants, there are many environmentally-detrimental consequences to consider. The removal of aquatic species during harvesting is non-selective. Native and invasive species alike are removed from the target area. This loss of plants results in a subsequent loss of the functions they perform, including sediment stabilization and wave absorption. Shoreline erosion may therefore increase. Other organisms such as fish, reptiles, and insects are often displaced or removed from the lake in the harvesting process. This may have adverse effects on these organisms' populations as well as the lake ecosystem as a whole.

While the results of harvesting aquatic plants may be short term, the negative consequences are not so short lived. Much like mowing a lawn, harvesting must be conducted numerous times throughout the growing season. Although the harvester collects most of the plants that it cuts, some plant fragments inevitably persist in the water. This may allow the invasive plant species to propagate and colonize in new, previously unaffected areas of the lake. Harvesting may also result in re-suspension of contaminated sediments and the excess nutrients they contain.

Disposal sites are a key component when considering the mechanical harvesting of aquatic plants. The sites must be on shore and upland to make sure the plants and their reproductive structures don't make their way back into the lake or to other lakes. The number of available disposal sites and their distance from the targeted harvesting areas will determine the efficiency of the operation, in terms of time as well as cost.

Timing is also important. The ideal time to harvest, in order to maximize the efficiency of the harvester, is just before the aquatic plants break the surface of the lake. For CLP, it should also be before the plants form turions (reproductive structures) to avoid spreading the turions within the lake. If the harvesting work is contracted, the equipment should be inspected before and after it enters the lake. Since these machines travel from lake to lake, they may carry plant fragments with them, and facilitate the spread of AIS from one body of water to another. Harvesting contractors are not readily available in northern Wisconsin, so harvesting contracts are likely to be very expensive.

Using mechanical harvesting is not recommended for Little Trade Lake because there is no harvesting equipment that could gain access to the lake. It is also likely that mechanical harvesting would exacerbate the EWM problem by fragmenting and spreading a lot of it.

#### **SMALL-SCALE CUTTING WITH REMOVAL**

There are a wide range of small-scale mechanical harvesting techniques, most of which involve the use of boat mounted rakes, scythes, and electric cutters. As with all mechanical harvesting, removing the cut plants is required. Commercial rakes and cutters range in prices from \$200 for rakes to around \$3000 for electric cutters with a wide range of sizes and capacities. Any of these cutters that are not entirely human powered require a permit for use.

Using a weed rake or cutter that is run by human power is allowed without a permit, but the use of any device that includes a motor, gas or electric, would require a permit. Dragging a bed spring or bar behind a boat, tractor or any other motorized vehicle to remove vegetation is also illegal without a permit. Although not truly considered mechanical management, incidental plant disruption by normal boat traffic is a legal method of management. Active use of an area is often one of the best ways for riparian owners to gain navigation relief near their docks. Most aquatic plants won't grow well in an area actively used for boating and swimming. It should be noted that purposefully navigating a boat to clear large areas is not only potentially illegal it can also re-suspend sediments, encourage AIS growth, and cause ecological disruptions.

Small-scale harvesting by human power that is completed in a way such that all of the EWM or CLP plant and root structure is removed is recommended for limited control of AIS in the lake. When removing aquatic plants manually, there is a restriction of no more than 30 feet wide for property owners to remove native vegetation, but there is no such limit on AIS. If done in a way that is entirely human powered, there is no limit on the amount of AIS that can be removed from the system. Any plants that are cut or pulled must still be removed from the lake. Through information and training, property owners will be instructed on proper physical removal methods. Small-scale cutting and removal is recommended for individual property owners or as a volunteer fair activity that is sponsored by the RTLIA.

#### **BOTTOM BARRIERS AND SHADING**

Physical barriers, fabric or other, placed on the bottom of the lake to reduce EWM growth would eliminate all plants, inhibit fish spawning, affect benthic invertebrates, and could cause anaerobic conditions which may release excess nutrients from the sediment. Gas build-up beneath these barriers can cause them to dislodge from the bottom and sediment can build up on them allowing EWM to re-establish. Bottom barriers are typically used for very small areas and provide only limited relief. Currently the WDNR does not permit this type of control.

Creating conditions in a lake that may serve to shade out EWM growth has also been tried with mixed success. The general intention is to reduce light penetration in the water which in turns limits the depth at which plants can grow. Typically dyes have been added to a small water body to darken the water. Bottom barriers and attempts to further reduce light penetration in Little Trade Lake are not recommended.

## **DREDGING**

Dredging is the removal of bottom sediment from a lake. Its success is based on altering the target plant's environment. It is not usually performed solely for aquatic plant management but rather to restore lakes that have been filled in with sediment, have excess nutrients, inadequate pelagic and hypolimnetic zones, need deepening, or require removal of toxic substances (Peterson, 1982). In shallow lakes with excess plant growth, dredging can make areas of the lake too deep for plant growth. It can also remove significant plant root structures, seeds/turions, rhizomes, tubers, etc. In Collins Lake, New York the biomass of curly-leaf pondweed remained significantly lower than pre-dredging levels 10-yrs after dredging (Tobiessen, Swart, & Benjamin, 1992). Dredging is very expensive, requires disposal of sediments, and has major environmental impacts. It is not a selective procedure so it can't be used to target any one particular species with great success except under extenuating circumstances. Dredging at any level must be permitted by the WDNR if it is done through mechanical means. Manual dredging of up to 100 cubic feet for may be done without a permit by property owners if all criteria found in the WDNR's exemption checklist (Appendix J) are met. It should not be performed for aquatic plant management alone. It is best used as a multipurpose lake remediation technique (Madsen, 2000).

Dredging is not a recommended management action for Little Trade Lake.

## **DRAWDOWN**

Drawdown, like dredging, alters the plant environment by removing all water in a water body to a certain depth, exposing bottom sediments to seasonal changes including temperature and precipitation. A winter drawdown is a low cost and effective management tool for the long-term control of certain susceptible species of nuisance aquatic plants. Winter drawdown has been shown to be an effective control measure for EWM, but typically only provides 2-3 years of relief before EWM levels return to pre-drawdown levels. A winter drawdown controls susceptible aquatic plants by dewatering a portion of the lake bottom over the winter, and subsequently exposing vascular plants to the combined effect of freezing and desiccation (drying). The effectiveness of drawdown to control plants hinges on the combined effect of the freezing and drying. If freezing and dry conditions are not sustained for 4-6 weeks, the effectiveness of the drawdown may be diminished.

It is not possible to draw down Little Trade Lake as there is no way to manipulate the water level at the existing outlet.

## **BIOLOGICAL CONTROL**

Biological control involves using one plant, animal, or pathogen as a means to control a target species in the same environment. The goal of biological control is to weaken, reduce the spread, or eliminate the unwanted population so that native or more desirable populations can make a comeback. Care must be taken however, to insure that the control species does not become as big a problem as the one that is being controlled. A special permit is required in Wisconsin before any biological control measure can be introduced into a new area.

### **EWM WEEVILS**

While many biological controls have been studied, only one has proven to be effective at controlling EWM under the right circumstances. *Euhrychiopsis lecontei* is an aquatic weevil native to Wisconsin that feeds on aquatic milfoils (Figure 30). Their host plant is typically northern watermilfoil; however they seem to prefer EWM when it is available. Milfoil weevils are typically present in low numbers wherever northern or Eurasian water milfoil is found. They often produce several generations in a given year and over winter in undisturbed shorelines around the lake. All aspects of the weevil's life cycle can affect the plant. Adults feed on the plant and lay their eggs. The eggs hatch and the larva feed on the plant. As the larva mature they eventually burrow into the stem of the plant. When they emerge as adults later, the hole left in the stem reduces buoyancy often

causing the stem to collapse. The resulting interruption in the flow of carbohydrates to the root crowns reduces the plant's ability to store carbohydrates for over wintering reducing the health and vigor (Newman, Holmberg, Biesboer, & Penner, 1996).



**Figure 30: EWM Weevil** (<https://klsa.wordpress.com/published-material/milfoil-weevil-guide/>)

The weevil is not a silver bullet. They do not work in all situations. The extent to which weevils exist naturally in a lake, adequate shore land over wintering habitat, the population of bluegills and sunfish in a system, and water quality characteristics are all factors that have been shown to affect the success rate of the weevil. The use of weevils is not recommended in this management plan, particularly since the process necessary to do so has changed significantly in the last few years. There is no longer a company that “raises” weevils for EWM control. Weevils can still be raised by volunteers in cooperation with an overseeing entity, but requires that all EWM used in the rearing process be secured from the host lake, and only weevils reared on host lake EWM can be released into the host lake. Further monitoring and possible weevil rearing is not recommended for Little Trade Lake in this management plan, but would not hurt if there were interested people to do so on the lake.

#### GALERUCELLA BEETLES

Two species of Galerucella beetles are currently approved for the control of purple loosestrife in Wisconsin (Figure 31). The entire lifecycle of Galerucella beetles is dependent on purple loosestrife. In the spring, adults emerge from the leaf litter below old loosestrife plants. The adults then begin to feed on the plant for several days until they begin to reproduce. Females lay their eggs on loosestrife leaves and stems. When the larvae emerge from these eggs they begin feeding on the leaves and developing shoots. When water levels are high these larvae will burrow into the loosestrife stems to pupate into adult beetles. These new adults emerge and begin feeding on the loosestrife again (Sebolt, 1998). Galerucella beetles do not forage on any plants other than purple loosestrife. Because of this the populations, once established, are self-regulating. When the purple loosestrife population drops off, the beetle population also declines. When the loosestrife returns, the beetle numbers will usually increase.





**Figure 31: Galerucella beetle**

These beetles will not eradicate purple loosestrife entirely. This is true of almost all forms of biological control. Galerucella beetles will help regulate loosestrife which will allow native plants to also become established. This allows the wetlands near Little Trade Lake to be diverse plant communities instead of purple loosestrife monocultures.

Beetles can be obtained from the WDNR, private vendors, or many of the public wetlands around Wisconsin. Because rearing these beetles requires the cultivation of a restricted species, a permit is necessary. Beetle rearing and release is not recommended for Little Trade Lake in this management plan, but if there are lake residents who wish to do so it has the potential to benefit the lake.

#### **OTHER BIOLOGICAL CONTROLS**

There are other forms of biological control being used or researched. It was thought at one time that the introduction of plant eating carp could be successful. It has since been shown that these carp have a preference list for certain aquatic plants. EWM and CLP are very low on this preference list (Pine & Anderson, 1991). Use of “grass carp” as they are referred to in Wisconsin is illegal as there are many other environmental concerns including what happens once the target species is destroyed, removal of the carp from the system, impacts to other fish and aquatic plants, and preventing escapees into other lakes and rivers. Several pathogens or fungi are currently being researched that when introduced by themselves or in combination with herbicide application can effectively control EWM and lower the concentration of chemical used or the time of exposure necessary to kill the plant (Sorsa, Nordheim, & Andrews, 1988). None of these have currently been approved for use in Wisconsin and are not recommended for use in Little Trade Lake.

#### **NATIVE PLANT RESTORATION**

A healthy population of native plants might slow invasion or reinvasion of non-native aquatic plants. It should be the goal of every management plan to protect existing native plants and restore native plants after the invasive species has been controlled. In many cases, a propagule bank probably exists that will help restore native plant communities after the invasive species is controlled (Gettsinger, Turner, Madson, & Netherland, 1997). Little Trade Lake would benefit from a native plant restoration effort if private land owners are interested in these efforts. Because there are no publicly owned lands adjacent to the shores of Little Trade Lake, it would be necessary for individual property owners to do a native plant restoration.

#### **CHEMICAL CONTROL**

Aquatic herbicides are granules or liquid chemicals specifically formulated for use in water to kill plants or cease plant growth. Herbicides approved for aquatic use by the U.S. Environmental Protection Agency (EPA)



are considered compatible with the aquatic environment when used according to label directions. Some individual states, including Wisconsin, also impose additional constraints on herbicide use.

The Wisconsin Department of Natural Resources evaluates the benefits of using a particular chemical at a specific site vs. the risk to non-target organisms, including threatened or endangered species, and may stop or limit treatments to protect them. The Department frequently places conditions on a permit to require that a minimal amount of herbicide is needed and to reduce potential non-target effects, in accordance with best management practices for the species being controlled. For example, certain herbicide treatments are required by permit conditions to be in spring because they are more effective, require less herbicide and reduce harm to native plant species. Spring treatments also means that, in most cases, the herbicide will be degraded by the time peak recreation on the water starts.

The WDNR encourages minimal herbicide use by requiring a strategic Aquatic Plant Management (APM) Plan for management projects over 10 acres or 10% of the water body or any projects receiving state grants. WDNR also requires consideration of alternative management strategies and integrated management strategies on permit applications and in developing an APM plan, when funding invasive species prevention efforts, and by encouraging the use of best management practices when issuing a permit. The Department also supervises treatments, requires that adjacent landowners are notified of a treatment and are given an opportunity to request a public meeting if they want, requires that the water body is posted to notify the public of treatment and usage restrictions, and requires reporting after treatment occurs.

The advantages of using chemical herbicides for control of aquatic plant growth are the speed, ease and convenience of application, the relatively low cost, and the ability to somewhat selectively control particular plant types with certain herbicides. Disadvantages of using chemical herbicides include possible toxicity to aquatic animals or humans, oxygen depletion after plants die and decompose which can cause fishkills, a risk of increased algal blooms as nutrients are released into the water by the decaying plants, adverse effects on desirable aquatic plants, loss of fish habitat and food sources, water use restrictions, and a need to repeat treatments due to existing seed/turion banks and plant fragments. Chemical herbicide use can also create conditions favorable for non-native AIS to outcompete native plants (for example, areas of stressed native plants or devoid of plants).

When properly applied, the possible negative impacts of chemical herbicide use can be minimized. Early spring to early summer applications are preferred because exotic species are actively growing and many native plants are dormant, thus limiting the loss of desirable plant species; plant biomass is relatively low minimizing the impacts of de-oxygenation and contribution of organic matter to the sediments; fish spawning has ceased; and recreational use is generally low limiting human contact. The concentration and amount of herbicides can be reduced because colder water temperatures enhance the herbicidal effects. Selectivity of herbicides can be increased with careful selection of application rates and seasonal timing. Lake hydro-dynamics must also be considered; steep drop-offs, inflowing waters, lake currents and wind can dilute chemical herbicides or increase herbicide drift and off-target injury. This is an especially important consideration when using herbicides near environmentally sensitive areas or where there may be conflicts with other water uses in the treatment vicinity.

Although done less frequently, herbicides can be applied in the late fall when most native plants have begun to die on their own, or have already gone dormant for the season. Typically invasive plant species like EWM will continue to grow well into the fall. Timing of a fall application of herbicides can be such that few native plants are expected to be killed. In some bodies of water, particularly those where wild rice is present, it may be possible to treat later in the fall, having no effect on wild rice that has already completed its life cycle. Wild rice in the seedling stage below the surface of the water is very susceptible to herbicides including 2, 4-D, endothall, and others. In most cases, herbicides are not used where wild rice is present. But in extreme cases, where the presence of EWM is actually causing great harm to the wild rice, fall treatments have been completed.

In some lakes, poor water clarity in the summer months may limit the growth of EWM, until the water clears in the fall and EWM all of a sudden gets more of the light needed to begin accelerated growth. The herbicide applied in the fall may be the same herbicide as applied in the spring and may be applied at the same concentration. One drawback is that the results of a fall treatment cannot be quantified until the next season.

#### HOW CHEMICAL CONTROL WORKS

Aquatic herbicides are sprayed directly onto floating or emergent aquatic plants or are applied to the water in either a liquid or granular form. Herbicides affect plants through either systemic or direct contact action. Systemic herbicides are capable of killing the entire plant. Contact herbicides cause the parts of the plant in contact with the herbicide to die back, leaving the roots alive and able to re-grow.

Herbicides can be classified as broad-spectrum (kill or injure a wide variety of plant species) or selective (effective on only certain species). Non-selective, broad spectrum herbicides will generally affect all plants that they come in contact with. Selective herbicides will affect only some plants. Often dicots, like Eurasian water milfoil, will be affected by selective herbicides whereas monocots, such as common waterweed will not be affected. The selectivity of a particular herbicide can be influenced by the method, timing, formulation, and concentration used.

Sonar® whose active ingredient is fluridone, is a broad spectrum herbicide that interferes with the necessary processes in a plant that create the chlorophyll needed to turn sunlight into plant food through a process called photo-synthesis. Rodeo® whose active ingredient is glyphosate is another broad spectrum herbicide that prevents an aquatic plant from making the protein it needs to grow. As a result the treated plant stops growing and eventually dies.

2, 4-D and triclopyr are active ingredients in several selective herbicides including Navigate®, DMA 4®, and Renovate®. These herbicides stimulate plant cell growth causing them to rupture, but primarily in dicots. These herbicides are considered selective as they have little to no effect on monocots in treated areas. Fluridone, glyphosate, 2, 4-D, and triclopyr are all considered systemic. When applied to the treatment area, plants in the treatment area draw the herbicide in through the leaves, stems, and roots killing all of the plant, not just the part that comes in contact with the herbicide.

Research done with triclopyr in 2014 (Vassios, et al., 2014) suggest that there is a difference between how the target plant is affected when using liquid or granular formulations of triclopyr. In short, liquid applications of triclopyr tend to build up quicker in the meristem or growing tip of EWM, while granular applications tend to build up more in the root crown of EWM. The indication was that perhaps treating a body of water with both the granular and liquid formulation of the herbicide would affect a greater area of the plant providing better results than either formulation alone. This research was only completed using triclopyr, but it may have some application with 2,4-D as well, given that both herbicides affect the target plant in a similar way.

Aquathol whose active ingredient is endothall; Reward whose active ingredient is diquat; and Cutrine whose active ingredient is a form of copper are considered broad spectrum contact herbicides. They destroy the outer cell membrane of the material they come in contact with and therefore kill a plant very quickly. None of these three are considered selective and have the potential to kill all of the plant material that they come in contact with regardless of the species. As such, great care should be taken when using these products. Certain plant species like curly-leaf pondweed begin growing very early in the spring, even under the ice, and are often the only growing plant present at that time. This is a good time to use a contact herbicide like Aquathol, as few other plants would be impacted. Using these products later in the season, will kill all vegetation in contact with the herbicide and can provide substantial nuisance relief from a variety of aquatic plants.

It is possible to apply more than one herbicide at a time when trying to establish control of unwanted aquatic vegetation. An example would be controlling EWM and CLP at the same time with an early season application, and controlling aquatic plants and algae at the same time during a mid-season nuisance relief application. Applying systemic and contact herbicides together has a synergistic effect leading to increased selectivity and control. Single applications of the two could result in reduced environmental loading of herbicides and monetary savings via a reduction in the overall amount of herbicide used and of the manpower and number of application periods required to complete the treatment.

#### EFFICACY OF AQUATIC HERBICIDES

The efficacy of aquatic herbicides is dependent on both application concentration and exposure time, and these factors are influenced by two separate but interconnected processes - dissipation and degradation. Dissipation is the physical movement of the active herbicide within the water column both vertically and horizontally. Dissipation rates are affected by wind, water flow, treatment area relative to untreated area, and water depths. Degradation is the physical breakdown of the herbicide into inert components. Depending on the herbicide utilized, degradation occurs over time either through microbial or photolytic processes.

#### MICRO AND SMALL-SCALE HERBICIDE APPLICATION

The determining factor in designating chemical treatments as micro or small-scale is the size of the area being treated. Small-scale herbicide application involves treating areas less than 10 acres in size. The dividing line between small-scale and micro treatments is not clearly defined, but is generally considered to be less than 3 acres. Small-scale chemical application is usually completed in the early season (April through May). Micro treatments are as well, but may be used as follow-up spot treatments after an early season application, or in instances where a new infestation has been identified in a lake with EWM already or in a completely new lake. Recent research related to micro and small-scale herbicide application generally shows that these types of treatment are less effective than larger scale treatments due to rapid dilution and dispersion of the herbicide applied.

Some suggested ways to increase the effectiveness of this management strategy are to increase the concentration of herbicide used, use a contact herbicide like diquat that does not require as long a contact time to be effective, or in some manner contain the herbicide in the treated area by artificial means.

Pre- and post-treatment aquatic plant surveys and testing for herbicide residuals are not required by the WDNR for small-scale treatments. Nor is an approved APMP if the organization sponsoring the application is not using grant funding to help defer the costs. Even though not required by the WDNR, participating in these activities is recommended as it helps to gain a better understanding of the impact and fate of the chemical used.

#### LARGE-SCALE HERBICIDE APPLICATION

Large-scale herbicide application involves treating areas more than 10 acres in size. Like small-scale applications, this is usually completed in the early-season (April through May) for control of non-native invasive species like EWM and CLP while minimizing impacts on native species. It is generally accepted that lower concentration of herbicide can be used in large-scale applications as the likelihood of the herbicide staying in contact with the target plant for a longer time is greater. If the volume of water treated is more than 10% of the volume of the lake, or the treatment area is  $\geq 160$  acres, or 50% of the lakes littoral zone, effects can be expected at a whole-lake scale. Large-scale herbicide application can be extended in some lakes to include whole bay or even whole lake treatments. The bigger the treatment area, the more contained the treatment area, and the depth of the water in the treatment area, are factors that impact how whole bay or whole lake treatments are implemented.

Pre- and post-treatment aquatic plant surveying and having an approved APMP are required by the WDNR when completing large-scale chemical treatments. Residual testing is not required by the WDNR, but highly recommended to gain a better understanding of the impact and fate of the chemical used.

#### WHOLE-LAKE, AND/OR EPIILMNION APPLICATION

Whole-lake or whole-basin treatments are those where the herbicide may be applied to specific sites, but the goal of the strategy is for the herbicide to reach a target concentration when it equally distributes throughout the entire volume of the lake (or lake basin, or within the epilimnion of the lake or lake basin). The application rate of whole-lake treatments is dictated by the volume of water in with which the herbicide will reach equilibrium. Because exposure time is expected to be so much longer, effective herbicide concentrations for whole-lake treatments are significantly less than required for spot treatments. Whole-lake treatments are typically conducted when the target plant is spread throughout the majority of the lake or basin.

If the herbicide exposure time of the target aquatic plant can be extended, the concentration of the herbicide applied can be lowered. If the contact time between the applied herbicide and the target plant in a whole body of water or protected bay can be increased to, or is already expected to be several days to a week or more, the concentration of herbicide can be in the range of 0.25-0.5 ppm instead of the 2-4 or more ppm that is typically used in small-scale, spot, or micro treatments.

Planning to treat the whole lake can be further designed to minimize the herbicide needed to affect the desired outcome. The method used to implement whole-lake treatments changes with the type of lake. Herbicide applied to a shallow, mixed lake is expected to mix throughout the entire volume of the lake. In deep water lakes that stratify, herbicide can be applied at such a time when it is expected that it will only mix with the surface water above the thermocline in an area known as the epilimnion. For this to be a viable management alternative, a lake has to stratify early enough in the open water season to coincide with the optimal time for early season chemical application.

It is likely that Little Trade Lake turns over several times throughout the year, so an epilimnion treatment is probably not possible, but whole lake treatments are.

#### EFFECTS OF WHOLE-LAKE TREATMENTS ON NATIVE AQUATIC PLANT SPECIES

Treating an entire lake with a chemical herbicide does have some concerns. One is particular is the effect on native aquatic plant vegetation in the treated body of water. Based on study results published by the WDNR in 2012 (Nault, et al., 2012) looking at nine different lakes that had whole-lake treatments completed, “year of treatment” effects on native plants were mostly negative, and on aggregate, 34 of the total 38 significant differences between species frequency of occurrence pre- and post-treatment were reductions, affecting 38 percent to 78 percent of the number of native species within a lake. Short-term reductions in native littoral frequency of occurrence occurred even at low concentrations of 2, 4-D if exposure times were long. Native dicots such as the watermilfoils (esp. northern watermilfoil), water marigold, and bladderworts are known to be susceptible to 2, 4-D, and displayed statistically-significant decreases in some of the case studies. At long-term exposures (across a range of concentrations) adverse impacts to relatively tolerant monocots such as naiads, several narrow leaf pondweeds, wild celery, and common waterweed were also observed. Water quality may also be affected by large-scale treatments. For example, in two lakes for which Secchi data was collected pre- and post-treatment (Sandbar and Tomahawk), a 40-percent reduction in water clarity was observed when comparing pre-treatment averages to year-of treatment averages. In another Wisconsin lake not part of this study (Bridge Lake), dissolved oxygen levels declined following a large-scale treatment that occurred relatively late in the season when water temperatures were higher.

## PRE AND POST TREATMENT AQUATIC PLANT SURVEYING

When introducing new chemical treatments to lakes where the treatment size is greater than ten acres or greater than 10% of the lake littoral area and more than 150-ft from shore, the WDNR requires pre and post chemical application aquatic plant surveying. The protocol for pre and post treatment survey is applicable for chemical treatment of CLP and EWM.

The WDNR protocol assumes that an APMP has identified specific goals for non-native invasive species and native plants species. Such goals could include reducing coverage by a certain percent, reducing treatments to below large-scale application designations, and/or reducing density from one level to a lower level. A native plant goal might be to see no significant negative change in native plant diversity, distribution, or density. Results from pre and post treatment surveying are used to improve consistency in analysis and reporting, and in making the next season's management recommendations.

The number of pre and post treatment sampling points required is based on the size of the treatment area. Ten to twenty acres generally requires at least 100 sample points. Thirty to forty acres requires at least 120 to 160 sampling points. Areas larger than 40 acres may require as many as 200 to 400 sampling points. Regardless of the number of points, each designated point is sampled by rake, recording depth, substrate type, and the identity and density of each plant pulled out, native or invasive.

In the year prior to an actual treatment, the area to be treated must have a mid-season/summer/warm water point intercept survey completed that identifies the target plant and other plant species that are present. A pre-treatment aquatic plant survey is done in the year the herbicide is to be applied, prior to application to confirm the presence and level of growth of the target species. A post-treatment survey should be scheduled when native plants are well established, generally mid-July through mid-August. For the post-treatment survey, repeat the PI for all species in the treatment polygons, as was done the previous summer. For whole-lake scale treatments, a full lake-wide PI survey should be conducted.

## CHEMICAL CONCENTRATION TESTING

Chemical concentration testing is often done in conjunction with treatment to track the fate of the chemical herbicide used. Testing is completed to determine if target concentrations are met, to see if the chemical moved outside its expected zone, and to determine if the chemical breaks down in the system as expected. Monitoring sites are located both within and outside of the treatment area, particularly in areas that may be sensitive to the herbicide used, where chemical drift may have adverse impacts, where movement of water or some other characteristic may impact the effect of the chemical, and where there may be impacts to drinking and irrigation water. Water samples are collected prior to treatment and for a period of hours and/or days following chemical application.

In some lakes, rhodamine dye is added to the herbicide at the time of application in amounts equal to the expected concentration of the herbicide and a fluorimeter is used to sample the dye as it moves around the system. Both systems for tracking the movement of the herbicide, concentration attained, and contact time maintained can be used effectively to help better current and future planning.

A rhodamine dye study was completed on Little Trade Lake in 2016, but only in the North Bay, coinciding with a diquat treatment in the bay. Chemical concentration testing has not been completed on Little Trade Lake, and is not required by the WDNR for chemical treatments, but this is recommended to gain a better understanding of the fate of the herbicide that is applied, particularly outside of the North Bay.

## HERBICIDE USE IN LITTLE TRADE LAKE

Little Trade Lake has a limited plant population. This is due in part to the overabundance of both CLP and EWM which in some years are successfully smothering out native plants. Restoration efforts have been fairly

successful with the use of herbicides. Native plants have either benefitted or have had limited negative and lasting effects.

Past chemical management has been completed using several different herbicides. In the north bay, the use of endothall for CLP and 2,4-D for EWM were less successful due to water movement through the area from the Trade River. Each of these herbicides requires a longer contact time with target plants to optimize their killing impact. Water movement through the treatment areas decreased the contact time between herbicide and target plant to less than optimal killing time. In 2016, diquat, a fast acting contact herbicide was used very effectively to control CLP and EWM. In the rest of the lake, using a combination of endothall for CLP and 2,4-D for EWM has been most effective. Using endothall alone was not effective.

Diquat is typically applied in a liquid form. Endothall and 2,4-D can be applied in either a liquid or granular form. Both forms have been used in Little Trade Lake effectively. Assuming that proposed chemical treatment areas remain at an acre or larger, it is recommended that liquid forms of these chemicals continue to be used. Liquid herbicides are less expensive than their granular counterparts and are easier to apply in combination with each other.

2,4-D and Triclopyr are systemic herbicides approved for use in WI to control submersed aquatic vegetation like EWM. Systemic herbicides are meant to kill the entire plant by being absorbed into it. Presently triclopyr based herbicides are more expensive than 2, 4-D based herbicides, but could be used in a similar fashion to control undesirable AIS.

Research done with triclopyr in 2014 (Vassios, Nissen, Koschnick, & Heilman, 2014) suggest that there is a difference between how the target plant is affected when using liquid or granular formulations of triclopyr. In short, liquid applications of triclopyr tend to build up quicker in the meristem or growing tip of EWM, while granular applications tend to build up more in the root crown of EWM. The indication was that perhaps treating a body of water with both the granular and liquid formulation of the herbicide would affect a greater area of the plant providing better results than either formulation alone. This research was only completed using triclopyr, but it may have some application with 2,4-D as well, and it would be interesting to complete a test treatment using this method.

Procellacor® is a new herbicide that acts similar to both contact and systemic herbicides. This allows for it to be effective with a shorter amount of contact time. The active ingredient in Procellacor® is an organic compound which mimics the plant hormone auxin. The auxins that are produced naturally within plants stimulate stem elongation and while suppressing bud growth. However when auxin concentrations within plant tissues reach a certain threshold, the growth response is completely reversed. The plant begins to, essentially, prepare for a dormant period by stopping growth altogether and abscising leaves. At this point, additional auxins (or their mimics) will become toxic to the plant and result in cell death. This herbicide is not currently approved for use within Wisconsin, but it is currently under review by through the Wisconsin Environmental Policy Act (WEPA). There is little information on the recommended time-frame or concentrations of treatments with Procellacor® due to the lack of State approval; however if approved for use within Wisconsin, this herbicide should be reviewed and considered for use in the Trade River system.

In order to effectively manage both EWM and CLP, both systemic and contact herbicides should be applied early in the season. This will allow EWM and CLP to be heavily impacted while native plants, which have not yet begun to grow, will be minimally affected.

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## MANAGEMENT DISCUSSION

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### EWM

The littoral (plant growing) zone of Little Trade Lake in 2016 was approximately 72 acres (approximately 57% of the total surface area). Since 2011, the amount of EWM in Little Trade Lake as identified by fall bed-mapping surveys has fluctuated between 0.34 and 4.65 acres in beds (>50% EWM with a defined edge) and/or high density areas (>25% EWM with a defined edge) (Table 6). These values represent 0.5-6.5% of the littoral zone. Based on these numbers it is a reasonable goal to keep the level of EWM in Little Trade Lake as identified in a fall bed mapping survey, below 1.0 acres of the littoral zone (1.4%) in any given year.

**Table 8: EWM Distribution based on Fall Bed-mapping Surveys**

Fall Bed Mapping Results		
Year	Total Acres	Notes
2011	1.95	Treated with 2,4-D (granular), poor results in northbay
2012	2.57	Treatd with 2,4-D (granular), poor results in north bay
2013	4.65	Treated with 2,4-D and endothall, varied results
2014	4.32	No treatment due to high water
2015	4.23	Treated with endothall, poor results
2016	0.34	Treated with diquat, endothall, and 2,4-D, great results
2017	NA	no treatment, Fall survey not completed at the time of this report

### APPLICATION OF AQUATIC HERBICIDES

If the total amount of EWM identified during a fall bed-mapping survey of the littoral zone reaches or exceeds 1.0 acre or 1.4% of the littoral zone, then the application of herbicide will be considered. Proposed treatment areas will not be less than 1.0 acres in size. Any bed or high density area of EWM that exceeds 0.02 acres (approximately 900-ft<sup>2</sup>) will be included in a preliminary early season treatment proposal for the given year. A buffer of 25-50 feet will be established around identified beds. Gaps between beds may also be included in proposed treatment areas if the two beds in question are close to one another, or if the area between the two beds has been known to support EWM growth based on past mapping actions. If herbicides are incorporated in a treatment plan for a given year, both CLP and EWM will be targeted at the same time using endothall at 1.0-3.0 ppm and 2,4-D at 2.0-4.0 ppm. Assuming treatment areas are at least one acre in size, liquid formulations of these herbicides will be used. EWM and/or CLP in the North Bay will be treated with diquat or some other fast-acting, contact herbicide, approved for use in aquatic systems.

### CLP

CLP is well established in Little Trade Lake covering as much as 40 plus acres or nearly 56% of the littoral zone in any given year based on 2009 and 2016 survey results. The majority of this growth is considered moderate to dense in nature interfering with native aquatic plant growth in the spring, causing navigation and nuisance conditions in parts of the lake in the late spring and early summer, and then contributing to nutrient loading and organic material build up in the sediment mid-summer. Reducing the amount of moderate to dense growth CLP by 50% would lessen the undesirable impacts of the plant in the lake.

CLP management to date has only been done in tandem with any EWM treatment that is considered. This approach has not been effective by itself in reducing the amount of CLP in the lake. As such, it is recommended that CLP continue to be treated in the same areas that are treated for EWM and in additional areas of developed shoreline or in sensitive areas very early in the season to allow for potential recovery of native plants. Any CLP that is targeted for chemical treatment should be treated for a minimum of 3 years, regardless of the presence of EWM or not.

#### **APPLICATION OF AQUATIC HERBICIDES**

To accomplish this goal, it is recommended that CLP be managed in two ways. First, since CLP and EWM usually are present in the same areas in the spring, it is recommended that both plants be treated at the same time applying herbicide specific to each species back to back. Previous results in Little Trade Lake (2013 & 2016) and Long Trade Lake (2013 & 2016) have shown this approach to be highly successful at controlling both species, for multiple years. Second, since there is a limited amount of EWM in Little Trade Lake, and a previous objective aims to keep it this way, treating additional CLP outside of the proposed EWM treatment areas is necessary to reduce the overall abundance by 50%. Large beds of dense growth CLP (>3.0 acres) that are present near developed areas of the lake or that impede navigation within the lake will also be targeted in the spring. Proposed CLP treatment areas will be no smaller than 3 acres and will be treated with endothall based herbicides at a concentration of 1.0-2.0 ppm. Should all combined treatment areas exceed 10% of the littoral zone (approximately 7.2 acres), official pre and post treatment, point-intercept, aquatic plant surveys will be completed. Once an area has been treated for the first time, treatment in that area will be continued for a minimum of two years more.

The success of these treatments will be measured by annual spring CLP bed-mapping, and by comparing turion density counts in the first year of treatment in this new plan (2018) with counts taken after a minimum of three years' worth of active management.

#### **AQUATIC PLANT SURVEYING**

Beginning in 2018, following year EWM treatment proposals will be based on late summer or early fall point-intercept survey work in the entire littoral zone of the lake. All aquatic plants in the littoral zone will be identified. If areas of EWM identified in beds and/or high density areas exceed 1.4 acres of the littoral zone or are causing a navigational impairment, a chemical treatment proposal will be made. If the size of the proposed treatment area reaches or exceeds 10% of the littoral zone (approximately 7.2 acres), pre and post treatment point-intercept aquatic plant surveys will be completed within the treated areas. If the proposed treatment area is less than 10% of the littoral zone, pre and post treatment point-intercept aquatic plant surveys are not required but will be considered if resources are available to support it. If pre and post treatment survey work is not done, a EWM Readiness survey will be completed in the proposed treatment areas prior to actual treatment to determine if an appropriate amount and level of CLP and EWM growth has been attained to implement the treatment. After any survey work, modifications to the initial treatment proposal will be made if necessary. The late summer/early fall point-intercept survey of the entire littoral zone will be used to make annual comparisons of treatment impacts on target and non-target aquatic plant species from year to year.

#### **OTHER AIS MONITORING AND MANAGEMENT**

RTLIA volunteers will continue to monitor the shoreline for purple loosestrife, removing what is found if possible. The RTLIA will be involved in rearing beetles for biological control of purple loosestrife however where those beetles are released each year will be determined by the location and most dense areas of purple loosestrife. For at least the last 5 years biological control beetles have been released on Round Lake, as the other lakes to date do not have large areas of purple loosestrife.



No formally recognized management of reed canary grass or Chinese mystery snails is expected, although shoreland improvement projects completed during the time span of this plan might impact the level of reed canary grass along the shore.

RTLIA volunteers will participate in the CLMN AIS Monitoring Program annually looking for zebra mussels, rusty crayfish, hydrilla, and other AIS not already in the lake.

#### **COARSE WOODY HABITAT**

Coarse woody habitat has never been quantified in Little Trade Lake. At some point during the implementation of this 5-year plan, the amount of CWH will be quantified and willing property owners sought for the installation of one or more CWH projects. Increasing the level of CWH in the lake would likely improve the overall fishery in the lake.

#### **SHORELAND IMPROVEMENT**

As increasing nutrients and sediment to the lake are a concern, and have led to a proposal to place Little Trade Lake on the EPA/State of Wisconsin Impaired Waters list, making improvements to the nearshore area around the lake and upstream of the lake in the Trade River could benefit the lake.

To that end, the WDNR has begun implementing a new Lake Shoreland and Shallows Habitat Monitoring Field Protocol (Appendix D) that involves assessing a 35-ft buffer area around the entire lake, documents shoreland condition through digital photography, and documents coarse woody debris in a lake. Information about the condition of the shoreline of Little Trade Lake would benefit future shoreland improvement planning and implementation through the WDNR Healthy Lakes grant program and other programs sponsored by the RTLIA and Burnett County. Polk County completed a Shoreland Habitat Assessment project on Long Trade Lake in 2017. A similar approach could be done by Burnett County on Little Trade Lake, although it is more likely that such an assessment would be completed by a consultant retained by the RTLIA with the cost being covered in a future lake management planning grant funded project aimed at developing a water quality based management plan for the lake. It is recommended that a shoreland habitat assessment survey be completed following the new WDNR protocol during the time frame covered by this APM Plan.

#### **WATER QUALITY**

It is recommended that the RTLIA continue to seek and support volunteers on Little Trade Lake who collect basic water quality data through the Citizen Lake Monitoring Network (CLMN) water quality monitoring program. This program begins with the collection of water clarity data, but can be expanded to include temperature and oxygen profiling, and collection of water samples to be analyzed for total phosphorus and chlorophyll a. It would also be beneficial to determine water and nutrient budgets for the lake.

A water budget is an accounting of all the water that flows into and out of a project area. This area can be a wetland, a lake, or any other point of interest. Development can alter the natural supply of water and severely impact an area, especially if there are nearby ponds or wetlands. A water budget is needed to determine the magnitude of these impacts and to evaluate possible mitigation actions. Components of a water budget include: precipitation, evaporation, evapotranspiration, surface runoff, and groundwater flow. The first three terms of the water budget equation, precipitation, evaporation, and evapotranspiration, are natural processes that are largely unaffected by development. However, changes in land use can significantly affect surface runoff and groundwater flow. For example, commercial development may intercept surface runoff that ran into a wetland and redirect it to a stormwater control basin. This stormwater basin may hold the water until it evaporates or release it to an outlet stream. In either case, the wetland is deprived of the surface runoff that was available before the development. Similarly, water supply wells can permanently lower groundwater levels and change flow directions.

The calculation of a nutrient budget is an essential step in the evaluation of a lake's trophic status. A nutrient budget provides a means to evaluate and rank nutrient sources that may contribute to algal problems. It is most important to determine the quantity of nutrients (especially phosphorus) entering the lake, as well as the ultimate fate of those nutrients. Components of a nutrient budget include: tributary loading and discharge; atmospheric loading; direct surface runoff; septic leachate and groundwater loading; groundwater phosphorus, and internal release of phosphorus from the sediment of the lake.

The RTLIA may be able to continue working with the Polk County Land and Water Resources Department or the Burnett County Land and Water Resource Department to develop a Comprehensive Lake Management Plan for Little Trade Lake. However, this may get completed faster if the RTLIA works with a private contractor using WDNR grants to support the planning process.

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## 2018-2022 AQUATIC PLANT MANAGEMENT GOALS, OBJECTIVES, AND ACTIONS

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Based on the information shared in this document the following aquatic plant management goals, objectives, and actions are recommended. The Goals, Objectives, and Actions are also available in Appendix E.

**Goal 1** – Promote and support aquatic plant management strategies that will control the spread of aquatic invasive species without negatively impacting native vegetation in Little Trade Lake.

- 1) Objective 1 – Keep level of EWM to below one acre as indicated by annual late summer point-intercept (PI) aquatic plant survey within the littoral zone fall
  - a) Action – Early season small-scale (<10 acres) or large-scale (>10 acres) herbicide application
    - i) Treated areas must be  $\geq 1$  acre
    - ii) Combine EWM and CLP treatments if in the same proposed area
    - iii) Herbicide concentration/dispersion monitoring within the treated area and at the outlet of the lake
  - b) Action – Physical Removal of EWM
    - i) Summer littoral visual surveys with removal
    - ii) Property owner removal near docks
  - c) Action – EWM surveys
    - i) Mid to late summer PI aquatic plant surveys within the littoral zone
    - ii) Treatment readiness survey – mid-April to mid-May
    - iii) Pre- and post-treatment aquatic plant survey work
      - (1) Only implemented if proposed treatment areas exceed 10% or 7.2 acres of the littoral zone
- 2) Objective 2 – Minimize negative impacts caused by dense growth CLP
  - a) Action – Early season small-scale herbicide application w/EWM
    - i) Treated areas must be  $\geq 1$  acres
    - ii) Combine EWM and CLP treatments if in the same proposed area
    - iii) Herbicide concentration/dispersion monitoring within the treated area and at the outlet of the lake
  - b) Action – Early season small or large-scale CLP treatment outside if EWM treatment areas
    - i) Treated areas must be  $\geq 3$  acres, with a rakehead density of 3
    - ii) Must be in areas with significant nuisance or navigation issues
      - (1) May occur in WDNR designated “sensitive areas”
    - iii) Once implemented, must be completed for a minimum of three years
  - c) Action – CLP surveys
    - i) CLP bed-mapping – June
    - ii) Treatment readiness survey – mid-April to mid-May
    - iii) Pre- and post-treatment aquatic plant survey work
      - (1) Only implemented if proposed treatment areas exceed 10% or 7.2 acres of the littoral zone
    - iv) Fall turion density sampling – 2018, and again after three years of active management
- 3) Objective 3 – Annual Summer Aquatic Plant Surveying
  - a) Action – Summer Littoral Point-Intercept Survey
    - i) All plants, entire littoral zone, point-intercept survey
    - ii) Mid to late summer
    - iii) Year to year comparisons

**Goal 2** – Reduce the threat that new AIS introduced to the lake will go undetected in the lake.

- 1) Objective 1 – AIS Monitoring
  - a) Action – Participate in CLMN AIS monitoring
  - b) Action – Implement fall dock and boatlift zebra mussel survey
- 2) Objective 2 – AIS Education
  - a) Action – Distribute AIS education and identification materials
  - b) Action – Plan and implement AIS identification and physical removal workshops
- 3) Objective 3 – AIS Control
  - a) Action – Implement physical removal or other approved management techniques when necessary

**Goal 3** – Promote and support nearshore and riparian best management practices that will improve fish and wildlife habitat, reduce runoff, and minimize nutrient loading into Little Trade Lake.

- 1) Objective 1 – Implement State of Wisconsin Healthy Lakes Initiative
  - a) Action – Complete a Shoreland Habitat Assessment on Little Trade Lake
  - b) Action - Promote Healthy Lakes projects based on the results of the Shoreland Habitat Assessment
  - c) Action – Apply for Healthy Lake grant funding to support projects that improve shoreland habitat and reduce runoff into the lake
  - d) Work with the developers/purchasers of the new lots on the east and northeast shore (if necessary) of the lake to encourage best management practices to maintain lake health
- 2) Objective 2 – Direct attention to water quality issues and how they could be addressed
  - a) Action - Research existing water quality, watershed, and nearshore condition of the lake
  - b) Action – Determine what information is needed to move water quality planning forward
  - c) Action – Consider application for lake management planning grant funding to support initial water quality management data collection and planning.
    - i) Include a feasibility study to evaluate hydraulic and nutrient loading to the lake
    - ii) Complete in-lake monitoring to determine recycling and profile characteristics

**Goal 4** – Complete appropriate and on-going tracking, monitoring, and management strategy modification to allow for thorough evaluation of management actions, and determinations that those management actions are on target, on track, on schedule, on budget, and within expected parameters.

- 1) Objective 1 – Continue water quality testing for Secchi, temperature, dissolved oxygen, total phosphorus, and chlorophyll a at the Deep Hole in Little Trade Lake
  - a) Action – Continue involvement in the Citizen Lake Monitoring Network (CLMN)
  - b) Action – Purchase a Temp/DO meter to support water quality testing on Little Trade Lake
    - i) Monitor DO throughout the entire year
- 2) Objective 2 – Complete Annual Project Activity and Assessment Reports
  - a) Action – The RTLIA and their Consultant will prepare end-of-year reports summarizes the management actions taken and how they impacted the lake.
  - b) Action – Review end of year summary reports with the RTLIA and WDNR to determine following year management actions.

**Goal 5** – Encourage and engage lake residents and visitors to be active lake stewards.

- 1) Objective 1 – Promulgate behavior change in residents in the following areas: AIS, shoreland development, aquatic vegetation, and responsibility for the lake.
  - a) Action – Encourage lake residents to understand AIS concerns, learn to identify AIS, watch for and identify AIS in the lake, and report what they find and/or remove it
  - b) Action – Encourage boaters to implement appropriate AIS prevention strategies on their watercraft; observe no-wake rules for boats and PWC close to shore and to each other; and be considerate of others on the lake
  - c) Action – Encourage lake residents to let vegetation in the water grow and to plant native plants along their shore
  - d) Action – Encourage lake residents to care for their lake, not just their lawn
    - i) Provide education materials, welcome packets, newsletters, information/education displays, Facebook, webpage, meetings and other resources to increase the level of public awareness on the lake
    - ii) Establish and develop volunteer lake leadership
      - (1) Attend conferences
      - (2) Recruit new representatives from Little Trade Lake to be active board/committee members
      - (3) Encourage more membership by Little Trade Lake residents in the RTLIA
      - (4) Encourage lake volunteer involvement in “lake leaders” training
    - iii) Strive to engage the youth in preserving the future health of the lake
    - iv) Highlight examples of good shoreland practices on the lake
    - v) Recognize good lake stewards for the efforts they extend

**Goal 6** – Implement the Little Trade Lake Management Plan effectively and efficiently with a focus on community and constituent education, information, and involvement.

- 1) Objective 1 - Build and support partnerships.
  - a) Action – Work with WDNR, Burnett County, Town of Trade Lake, local businesses, contractors, and other resources to support management actions
- 2) Objective 2 – Keep lake residents are informed about plan activities
  - a) Action – Continue supporting Little Trade Lake involvement in the RTLIA
  - b) Action – Continue reaching out to the lake constituency to inform and seek input for management actions
- 3) Objective 3 - Select cost effective implementation actions
  - a) Action – Work within the budget constraints to establish the best management actions to implement annually

Action – Apply for State of Wisconsin grant funding to support education, planning, and management implementation

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## IMPLEMENTATION AND EVALUATION

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This plan is intended to be a tool for use by the RTLIA to move forward with aquatic plant management actions that will maintain the health and diversity of Little Trade Lake and its aquatic plant community. This plan is not intended to be a static document, but rather a living document that will be evaluated on an annual basis and updated as necessary to ensure goals and community expectations are being met. This plan is also not intended to be put up on a shelf and ignored. Implementation of the actions in this plan through funding obtained from the WDNR and/or RTLIA funds is highly recommended. An Implementation and Funding Matrix is provided in Appendix F.

Since many actions occur annually, a calendar of actions to be implemented was created in Appendix G.

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## WISCONSIN DEPARTMENT OF NATURAL RESOURCES GRANT PROGRAMS

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There are several WDNR grant programs that may be able to assist the RTLIA in implementing its new APMP. AIS grants are specific to actions that involve education, prevention, planning, and in some cases implementation of AIS management actions. Lake Management Planning grants can be used to support a broad range of management planning and education actions. Lake Protection grants can be used to help implement approved management actions that would help to improve water quality. WDNR Healthy Lakes grants are part of the Lake Protection program.

### AIS PREVENTION AND CONTROL GRANTS

The AIS (AIS) Prevention and Control grants are a cost-share effort by the WDNR to provide information and education on types of existing and potential AIS in Wisconsin, the threats that invasive species pose to the state's aquatic resources, and available techniques for invasive species control. These grants also assist in the planning and implementation of projects that will prevent the introduction of invasive species into waters where they currently are not present, controlling and reducing the spread of invasive species from waters where they are present, and restoring native aquatic communities.

There are five AIS Prevention and Control grants subprograms:

- Education, Prevention and Planning Projects (including Clean Boats Clean Waters)
- Early Detection and Response Projects
- Established Population Control Projects
- Maintenance and Containment Projects
- Research and Demonstration Projects

Education, Prevention, and Planning; Established Population Control, Clean Boats, Clean Waters, and Maintenance and Containment grants are applicable to Little Trade Lake and the RTLIA.

### EDUCATION, PREVENTION AND PLANNING PROJECTS

Education projects are intended to broaden the public's awareness and understanding of, and ability to identify, AIS; the threats that AIS pose to the health of aquatic ecosystems; the measures to prevent the spread of AIS; and the management practices used for control of AIS. Prevention projects are intended to prevent the introduction of new AIS into a waterbody/wetland, or prevent the spread of an AIS population from one waterbody to another unpopulated waterbody/wetland. Planning projects are intended to assist in the development of plans for the prevention and control of AIS. Eligible projects include:

- Educational programs including workshops, training sessions, or coordinated volunteer monitors. Projects will be reviewed for consistency with the DNR's statewide education strategy for controlling AIS including the use of existing publications and outreach materials.
- Development of AIS prevention and control plans
- Monitoring, mapping, and assessing waterbodies for the presence of AIS or other studies that will aid in the AIS prevention and control.
- Watercraft inspection and education projects following the guidelines of the DNR's Clean Boats, Clean Waters program.

This subprogram is not intended to provide support for any management action that may be taken.

### *Funding Possibilities*

Maximum amount of grant funding is 75% of the total project costs, not to exceed \$150,000. Applications will be separated into two classes: less than \$50,000 in state funding and between \$50,001 and \$150,000 in state funding. Clean Boats Clean Waters projects are limited to \$4,000 per public boat launch facility but may be a component of a larger project.

#### ESTABLISHED POPULATION CONTROL PROJECTS

Established population control grants are intended to assist applicants in eradicating or substantially reducing established populations of AIS to protect and restore native species communities. Established populations are defined as substantial reproducing populations of AIS that are not pioneer populations. Eligible projects include activities recommended in a DNR-approved control plan including monitoring, education, and prevention activities. Ineligible projects include the following:

- Dredging
- Chemical treatments or mechanical harvesting of aquatic plants to provide single season nuisance or navigational relief.
- Maintenance and operation of aeration systems and mechanical structures used to suppress aquatic plant growth.
- Structural facilities for providing boat washing stations. Equipment associated with boat washing facilities is eligible if included in a management plan.

### *Funding Possibilities*

Maximum amount of the grant funding is 75% of the total project costs, not to exceed \$200,000.

#### MAINTENANCE AND CONTAINMENT PROJECTS

Maintenance and containment grants are intended to provide sponsors limited financial assistance for the ongoing control of established AIS population without the assistance of an Established Population Control grant. These projects are intended for waters where management activity has achieved the target level of control identified in an approved plan that meets the criteria of s. NR 198.43, Wis. Adm. Code. Ongoing maintenance is needed to contain these populations so they do not re-establish throughout the waterbody, spread to other waters, or impair navigation and other beneficial uses of the waterbody.

### *Funding Possibilities*

Maximum amount of grant funding will be determined by DNR based on the sponsor's permit application fee, specified monitoring and reporting requirements in the permit, or DNR-approved management plan. The maximum grant amount shall not exceed the cost of the permit application fee.

#### LAKE MANAGEMENT PLANNING GRANTS

Lake management planning grants are intended to provide financial assistance to eligible applicants for the collection, analysis, and communication of information needed to conduct studies and develop management plans to protect and restore lakes and their watersheds. Projects funded under this subprogram often become the basis for implementation projects funded with Lake Protection grants. There are two categories of lake management planning grants: small-scale and large-scale.



## SMALL SCALE LAKE MANAGEMENT PROJECTS

Small-scale projects are intended to address the planning needs of lakes where education, enhancing lake organizational capacity, and obtaining information on specific lake conditions are the primary project objectives. These grants are well suited for beginning the planning process, conducting minor plan updates, or developing plans and specification for implementing a management recommendation. Eligible projects include:

- Collect and report chemical, biological, and physical data about lake ecosystems for a Tier I assessments, Tier II diagnostic or Tier III project evaluation.
  - Tier I if initial basic monitoring is needed to assess the general condition or health of the lake.
  - Tier II if an assessment has been conducted and more detailed data collection is needed to diagnose suspected problems and identify management options.
  - Tier III if the monitoring and assessment will be used to evaluate the effectiveness of a recently implemented project or lake management strategy.
- Collecting and disseminating existing information about lakes for the purpose of broadening the understanding of lake use, Lake Ecosystem conditions and lake management techniques.
- Conducting workshops or trainings needed to support planning or project implementation.
- Projects that will assist management units as defined in s. NR191.03 (4) & s. NR 190.003 (4) the formation of goals and objectives for the management of a lake or lakes.

### *Funding Possibilities*

Maximum amount of grant funding is 67% of the total project costs, not to exceed \$3,000.

## LARGE SCALE LAKE MANAGEMENT PROJECTS

Large-scale projects are intended to address the needs of larger lakes and lakes with complex and technical planning challenges. The result will be a lake management plan; more than one grant may be needed to complete the plan. Eligible projects include:

- Collection of new or updated, physical, chemical and biological information about lakes or lake ecosystems.
- Definition and mapping of Lake Watershed boundaries, sub-boundaries and drainage system components.
- Descriptions and mapping of existing and potential land conditions, activities and uses within lake watersheds that may affect the water quality of a lake or its ecosystem.
- Assessments of water quality and of fish, aquatic life, and their habitat.
- Institutional assessment of lake protection regulations - review, evaluation or development of ordinances and other local regulations related to the control of pollution sources, recreational use or other human activities that may impact water quality, fish and wildlife habitat, natural beauty or other components of the lake ecosystem.
- Collection of sociological information through surveys or questionnaires to assess attitudes and needs and identify problems necessary to the development of a long-term lake management plan.
- Analysis, evaluation, reporting and dissemination of information obtained as part of the planning project and the development of management plans.
- Development of alternative management strategies, plans and specific project designs, engineering or construction plans and specifications necessary to identify and implement an appropriate lake protection or improvement project.

### *Funding Possibilities*

Maximum amount of grant funding is 67% of the total project costs, not to exceed \$25,000. Multiple grants in sequence may be used to complete a planning project, not to exceed \$100,000 for each lake. The maximum grant award in any one year is \$50,000 for each lake. If phasing is necessary, all phases should be fully identified and a timeline identified in the initial application.

## **LAKE PROTECTION GRANTS**

Lake protection and classification grants assist eligible applicants with implementation of lake protection and restoration projects that protect or improve water quality, habitat or the elements of lake ecosystems. There are four basic Lake Protection subprograms: a) Fee simple or Easement Land Acquisition b) Wetland and Shoreline Habitat Restoration c) Lake Management Plan Implementation d) Healthy Lakes Projects.

### **HEALTHY LAKES PROJECTS**

The Healthy Lakes grants are a sub-set of Plan Implementation Grants intended as a way to fund increased installation of select best management practices (BMPs) on waterfront properties without the burden of developing a complex lake management plan. Details on the select best practices can be found in the Wisconsin Healthy Lakes Implementation Plan and best practice fact sheets.

Eligible best practices with pre-set funding limits are defined in the Wisconsin Healthy Lakes Implementation Plan, which local sponsors can adopt by resolution and/or integrate into their own local planning efforts. By adopting the Wisconsin Healthy Lakes Implementation Plan, your lake organization is immediately eligible to implement the specified best practices. Additional technical information for each of the eligible practices is described in associated factsheets. The intent of the Healthy Lakes grants is to fund shovel-ready projects that are relatively inexpensive and straight-forward. The Healthy Lakes grant category is not intended for large, complex projects, particularly those that may require engineering design. All Healthy Lake grants have a standard 2-year timeline.

### *Funding Possibilities*

Maximum amount of grant funding is 75% of the total project cost, not to exceed \$25,000. Grants run for a 2-year time period. Maximum costs per practice are also identified in the Wisconsin Healthy Lakes.

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## **Appendix A – WDNR Sensitive Areas Report**



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## **Appendix B – NR 109**



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## **Appendix C – NR 107**





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## **Appendix D – WDNR Shoreland and Shallows Habitat Assessment Guidelines**



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## **Appendix E – Goals, Objectives, and Actions**



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## **Appendix F – Funding and Implementation Matrix**



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## **Appendix G - Calendar of Actions**



